XZ040

USER MANUAL
FAMILY OF
12-BIT DIGITIZERS

For Use with DC440, DC438, DC436,
DP310, DP308, and DP306 Digitizers

August 2004

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1. Out of the Box

1.1. Message to the User

Congratulations on having purchased an Acqiris data conversion product. Acqiris Digitizers are high-speed data acquisition modules designed for capturing high frequency electronic signals. To get the most out of the products we recommend that you read this manual carefully. We trust the product you have purchased will meet with your expectations and provide you with a high quality solution to your data conversion applications.

1.2. Using this Manual

This guide assumes you are familiar with the operation of a personal computer (PC) running a Windows 95/98/2000/NT4/XP or other supported operating system. It also assumes you have a basic understanding of the principles of data acquisition using either a waveform digitizer or a digital oscilloscope.

The manual is divided into 5 separate sections. To understand the elements of operation for the module it is essential that you read them all.

Chapter 1 ***OUT OF THE BOX,*** describes what to do when you first receive your new Acqiris product. Special attention should be paid to sections on safety, packaging and product handling. Before installing your product please ensure that your system configuration matches or exceeds the requirements specified.

Chapter 2 ***INSTALLATION***, covers all elements of installation and performance verification. Before attempting to use your Acqiris product for actual measurements we strongly recommend that you read all sections of this chapter.

Chapter 3 ***PRODUCT DESCRIPTION***, provides a full description of all the functional elements of the digitizer.

Chapter 4 ***RUNNING THE ACQIRISLIVE APPLICATION***, describes the operation of AcqirisLive 2.13, an application that enables basic operation of Acqiris digitizers in a Windows 95/98/2000/NT4/XP environment.

Chapter 5 ***RUNNING THE GEOMAPPER APPLICATION***, describes the purpose and operation of the GeoMapper application which is needed for some ASBus Multi-instrument systems.

For information necessary for writing you own software to control Acqiris products you should refer to the **Programmer's Guide** and the **Programmer's Reference Manual**.

1.3. Conventions Used in This Manual

The following conventions are used in this manual:

⚠ This icon to the left of text warns that an important point must be observed.

WARNING Denotes a warning, which advises you of precautions to take to avoid being electrically shocked.

CAUTION Denotes a caution, which advises you of precautions to take to avoid electrical, mechanical, or operational damages.

NOTE Denotes a note, which alerts you to important information.

Italic text denotes a warning, caution, or note.

Bold Italic text is used to emphasize an important point in the text or a note

`mono` text is used for sections of code, programming examples and operating system commands.

1.4. Disclaimer and Safety

The DP Series 12-bit PCI Digitizer cards have been designed to operate in a standard PCI slot found inside most personal computers. The DC Series 12-bit CompactPCI/PXI Digitizers have been designed to operate inside a CompactPCI/PXI crate. The crate provides the modules with all needed power. Acqiris does not recommend operation of their DC modules outside of a CompactPCI/PXI crate.

⚠ ***CAUTION:*** ***Do not exceed the maximum input voltage rating! The maximum input voltage for the BNC channel inputs is ±10 V. The maximum input for the SMA channel inputs and the trigger BNC is ±5 V (dc + ac).***

1.5. Warning Regarding Medical Use

The Digitizer cards are not designed with components and testing procedures that would ensure a level of reliability suitable for use in treatment and diagnosis of humans. Applications of these cards involving medical or clinical treatment can create a potential for accidental injury caused by product failure, or by errors on the part of the user. These cards are ***not*** intended to be a substitute for any form of established process or equipment used to monitor or safeguard human health and safety in medical treatment.

⚠ ***WARNING:*** ***The modules discussed in this manual have not been designed for making direct measurements on the human body. Users who connect an Acqiris module to a human body do so at their own risk.***

1.6. Packaging and Handling

Your Digitizer is shipped with the following components:

- A compact disc that includes
  - 6 product user manuals in electronic form (Family of 8-bit Digitizers, Family of 12-bit Digitizers, Family of Averagers, Family of Analyzers, CC10X Family of CompactPCI Crates and CC121 CompactPCI Crate),
  - 1 Programmer's Guide and 1 Programmer's Reference Manual in electronic form,
  - device drivers with sample software for different operating systems, environments and languages,
  - the AcqirisLive application, a demonstration program for our digitizer and averager products,
  - the AP_SSRDemo application, a demonstration program for the Acqiris AP235/AP240 Analyzers,
  - the APx01Demo application, a demonstration program for the Acqiris AP101/AP201 Analyzers,
  - product data sheets,
  - other promotional literature
  - full installation procedures for use with Microsoft Windows, Phar Lap ETS, Wind River VxWorks, and Linux software.
- A declaration of conformity
- Optional documentation such as a model-dependent document giving Specifications & Characteristics, a Calibration Certificate, or a Performance Verification

After carefully unpacking all items, inspect each to ensure there are no signs of visible damage. Also check that all the components received match those listed on the enclosed packing list. Acqiris cannot accept responsibility for missing items unless we are notified promptly of any discrepancies. If any items

are found to be missing or are received in a damaged condition please contact the Customer Support Center or your local supplier immediately. Retain the box and packing materials for possible inspection and/or reshipment.

1.7. Warranty

All Acqiris Digitizer products are warranted to operate within specification, assuming normal operation, for a period of three years from the date of shipment. It is recommended that yearly calibration be made in order to verify product performance. All repairs, replacement and spare parts are warranted for a period of 3 months. A 5-year repair warranty is available as an option.

Acqiris endeavors to provide leading edge technology that includes the latest concepts in hardware and software design. As such software and firmware used with the products is under continual refinement and improvement. All software and instrument firmware is supplied “as is” with no warranty of any kind. Software and firmware is thoroughly tested and thought to be functional at the time of shipment. At Acqiris' discretion software and firmware may be revised if a significant operational malfunction is detected.

Products supplied but not manufactured by Acqiris are covered solely by the warranty of the original equipment manufacturer.

In exercising this warranty, Acqiris will repair or replace any product returned to the Customer Support Center, or an Authorized Repair Center, within the warranty period. The warranty covers all defects that are a result of workmanship or materials. This excludes defects that are caused by accident, misuse, neglect, or abnormal operation.

The purchaser is responsible for returning the goods to the nearest Customer Support Center. This includes transportation costs and insurance. Acqiris will return all warranty repairs with transportation prepaid.

1.8. Warranty and Repair Return Procedure, Assistance and Support

Before returning any Acqiris product for repair please contact your nearest service center for a Return Authorization Number (RAN). In order to issue your RAN we will require your name, company, phone number and address, the model and serial numbers of the unit to be repaired and a brief description of the problem.

As well as providing you with an RAN Acqiris Support Centers can assist you with any questions concerning the installation, operation or service of your equipment. For your nearest customer support center contact Acqiris at 1-877-ACQIRIS in the USA, +41 22 884 33 90 in Europe or +61 3 9888 4586 in the Asia-Pacific region.

1.9. System Requirements

In order to obtain reasonable performance from your digitizer, Acqiris products need the following minimum PC System Requirements:

Processor: 150 MHz Pentium (higher recommended)

Memory: 64 Mbytes RAM. The previous number is a very rough estimate. Assuming that you are using AcqirisLive or an application of your own that operates on the acquired data it seems reasonable to ask for 10 times the total acquisition memory that you will be using at the same time in the application. Performance is likely to be degraded if less memory is available.

Display resolution: At least 800 x 600 pixels and 256 colors for use of AcqirisLive or AcqirisDemo

Operating System: Microsoft Windows 95/98/2000/NT4/XP, Phar Lap Real-time ETS 12.0 Kernel, Wind River VxWorks 5.5.1, and Linux (RedHat 8.0 - Kernel Version 2.4.18, RedHat 9.0 - Kernel Version 2.4.20 or Debian - Kernel Version 2.4.25). Linux kernel driver source code is available for compilation.

Hard Drive Space: 20 Mbytes Minimum

CD Drive (or any method to copy Acqiris Software installation files from CD to the hard drive such as LAN, floppy drive, etc.)

ETS: The example files are for Microsoft Visual Studio 6.0 with Phar Lap ETS 12.0 support.

LabVIEW: The Acqiris LabVIEW driver is available for National Instruments LabVIEW versions 6.0, 6.1, 7.0, or 7.1

MATLAB: To successfully use the Acqiris MATLAB Adaptor you must have MathWorks MATLAB 6.5 with the Data Acquisition Toolbox

Visual BASIC: The interface files and examples are available for Microsoft Visual Basic versions 5 or 6 and the interface files only for .NET.

Tornado: The example files are useable with Wind River Tornado 2.2.1.

1.10. Transport

⚠ ***CAUTION: Cards can be safely transported in their original shipping packages. DC cards can be transported when properly mounted in a CompactPCI crate. The transport of DP cards mounted in a PC is a more delicate issue. Because of their mass the cards can vibrate loose unless they are properly secured and braced. DP cards held only in the front and on the bottom should not be shipped in their PC. However, properly mounted DP cards with XP103 fans can be sufficiently well held; the Adjustable retainer must be used so as to hold the card in place.***

1.11. Maintenance

The cards do not require any maintenance. There are no user serviceable parts inside. A periodic calibration can be obtained on request.

1.12. Cleaning

Cleaning procedures consist only of exterior cleaning.

Clean the exterior surfaces of the module with a dry lint-free cloth or a soft-bristle brush. If any dirt remains, wipe with a cloth moistened in a mild soap solution. Remove any soap residue by wiping with a cloth moistened with clear water. Do not use abrasive compounds on any parts.

2. Installation

This chapter describes how to install the Acqiris hardware and software for Windows 95/98/2000, Windows NT 4.0, Windows XP, Linux, Phar Lap, or VxWorks.

⚠ ***NOTE:*** *For a first time installation Acqiris strongly recommends installing the software* ***before*** *inserting the hardware into the PC.*

2.1. Installing the Software under Windows

2.1.1. Warnings

If Setup detects a previous installation of Acqiris software on your system, a warning screen will be displayed. It is recommended to exit Setup and uninstall older versions.

The installer from software releases prior to **Acqiris Software 2.0** installed the Digitizer Driver DLL files into the System directory. These will be removed by Setup. If you wish to keep the old installation on your system, you should exit Setup, and move all Acqiris driver files (acqiris*, acqrs* and acqir*) to some archive directory.

The DLL files will be installed into the bin subdirectory of the Acqiris software root, and the corresponding path will be added to the PATH environment variable.

2.1.2. Multiple Versions

With the software installation from **Acqiris Software 2.0** (or above), it is possible to keep multiple versions on the same system, but you must specify a different root directory (i.e. Install Folder). If you keep the same directory, Setup will overwrite your previous installation.

To go back to a previous version, you must change the PATH environment variable and reinstall the Kernel driver:

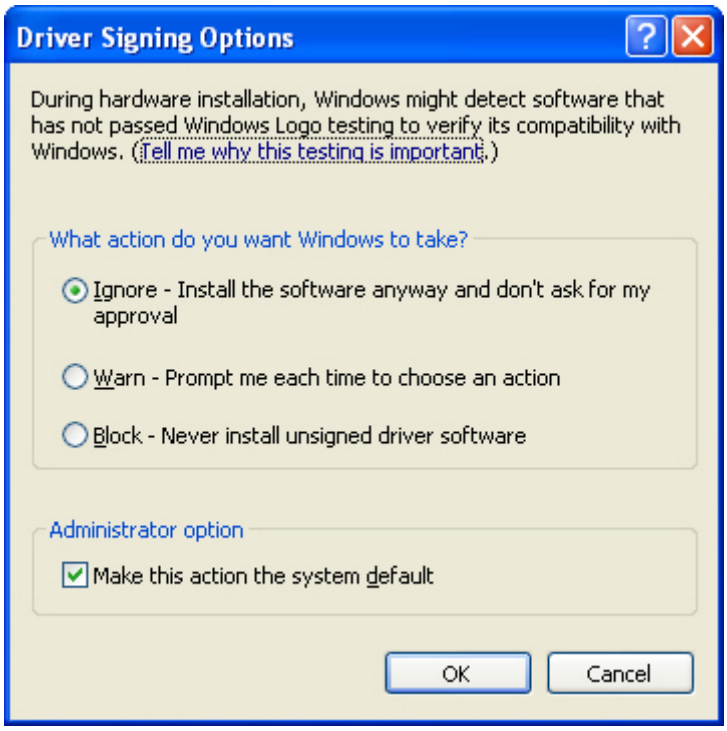
- Under Windows 95/98,
  1. Copy the VXD file from `<old_AcqirisSoftware_root>\bin\kernel` to the `Windows\System` directory.
  2. Change the AcqirisDxRoot environment variable to the old root.
  3. Reboot the computer.
- Under Windows 2000/NT4/XP,
  1. Copy the SYS file from `<old_AcqirisSoftware_root>\bin\kernel` to the `Windows\System32\drivers` directory.
  2. Change the AcqirisDxRoot, AcqirisDxDir and PATH environment variables to the old root.
  3. Reboot the computer.

2.1.3. Installation

Before installing the Acqiris hardware, you should complete the following steps to install the software for Windows 95/98/2000/NT4/XP.

⚠ ***NOTE:*** *You will need administrator privileges to complete the software installation under Windows 2000/NT4/XP.*

1. For **Windows XP** installation, Select the **Control Panel** under Settings in the **Start** menu. Then select **Printers and Other Hardware** followed by **System** and then display the **Hardware** tab to get access to the **Driver Signing** menu. Since the Acqiris driver has not been submitted for **Windows Logo testing** you must select either the **Ignore** or **Warn** action. The resulting menu looks as shown:

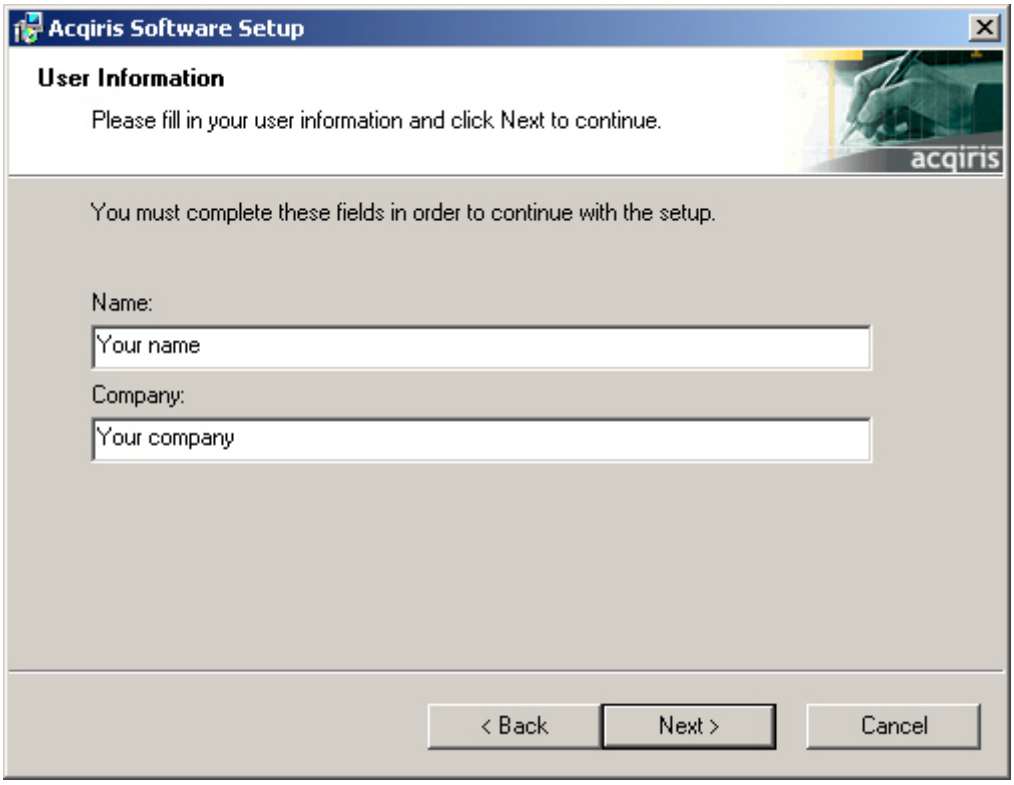

Driver Signing Options
During hardware installation, Windows might detect software that has not passed Windows Logo testing to verify its compatibility with Windows. (Tell me why this testing is important.)
What action do you want Windows to take?
Ignore - Install the software anyway and don't ask for my approval
Warn - Prompt me each time to choose an action
Block - Never install unsigned driver software
Administrator option
Make this action the system default
OK
Cancel

2. Insert the *Acqiris Software CD* into the CD-ROM drive of your computer. If the Autorun program does not start automatically (Autoplay disabled), you can start it manually, or navigate to the *AcqirisSoftware\Windows* folder in order to display the files included.

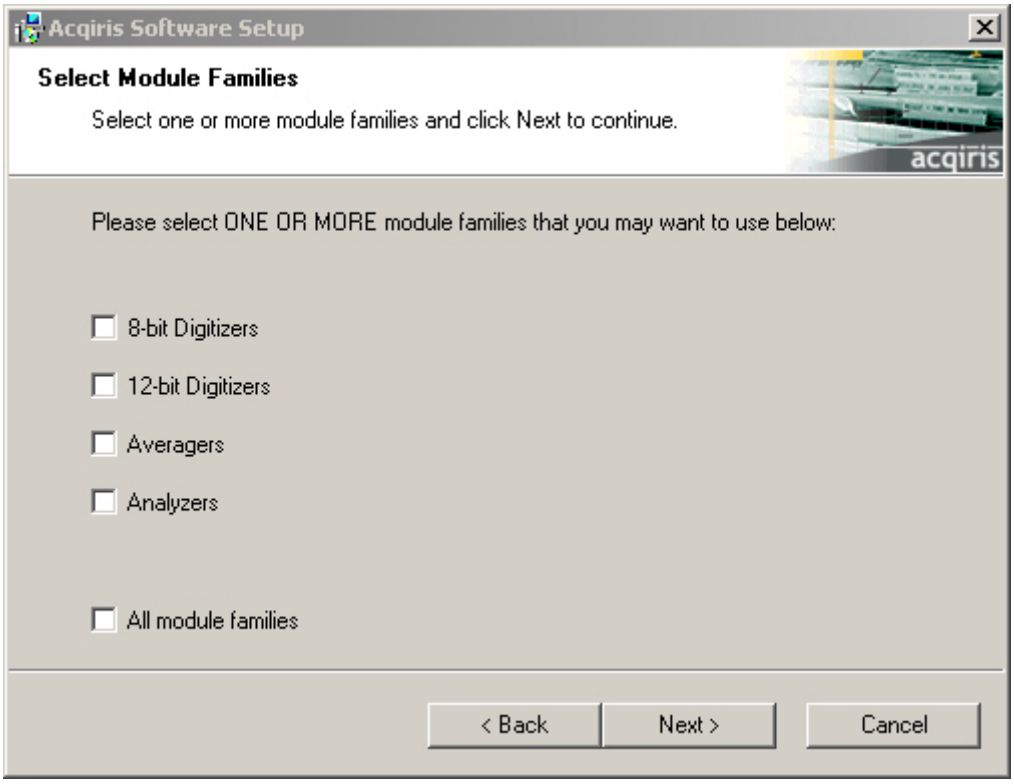
3. Choose **Install AcqirisSoftware for Windows95/98/NT4/2000/XP** (or run `Setup.exe` from the *AcqirisSoftware\Windows* folder). After several seconds for initialization the following screen will appear.

Acqiris Software Setup
Welcome
Welcome to the Acqiris Software setup program.
It is strongly recommended that you exit all Windows programs before running Setup. Click Cancel to quit Setup and close any programs you have running.
WARNING: This program is protected by copyright law and international treaties. Unauthorized reproduction or distribution of this program may result is severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under law.
Click Next to continue with the setup.
Easy to install in 3 minutes
acqiris
Next >
Cancel

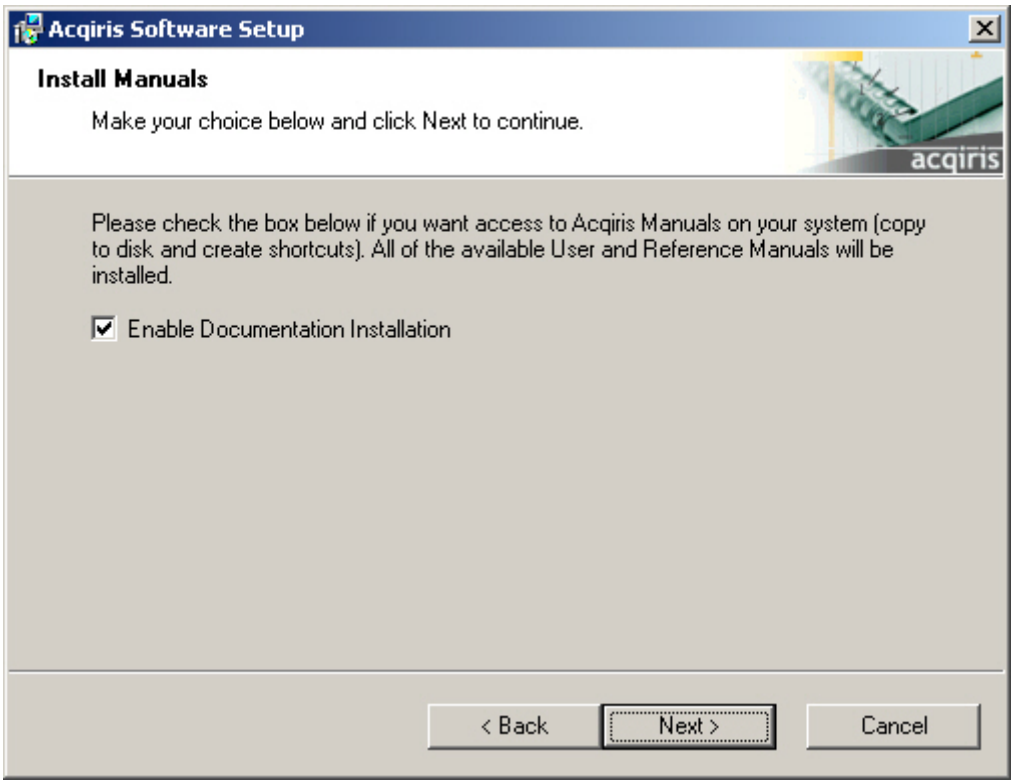
4. To proceed with the installation click “Next”. The following screen will be shown.



5. Please enter your user information and click “Next” to continue. If the program finds that there is still Acqiris software installed on your machine a warning panel (not shown) will appear. Otherwise, the next screen shows:

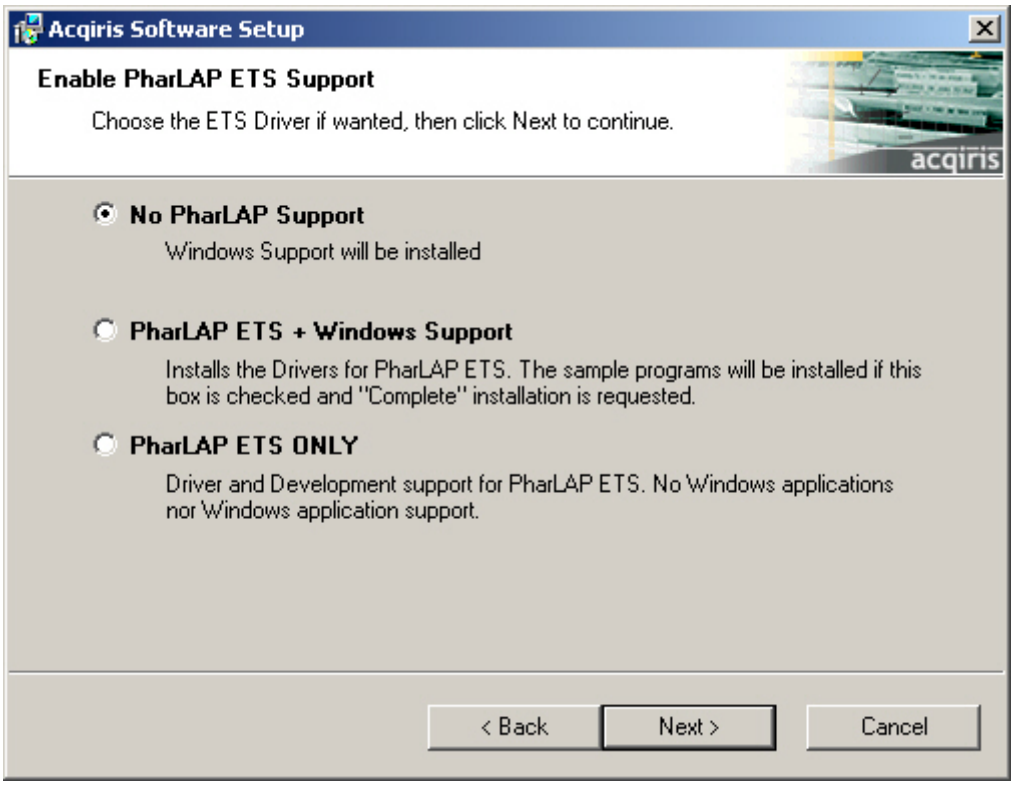


6. Pick the desired combination of module families and click "Next" to continue.

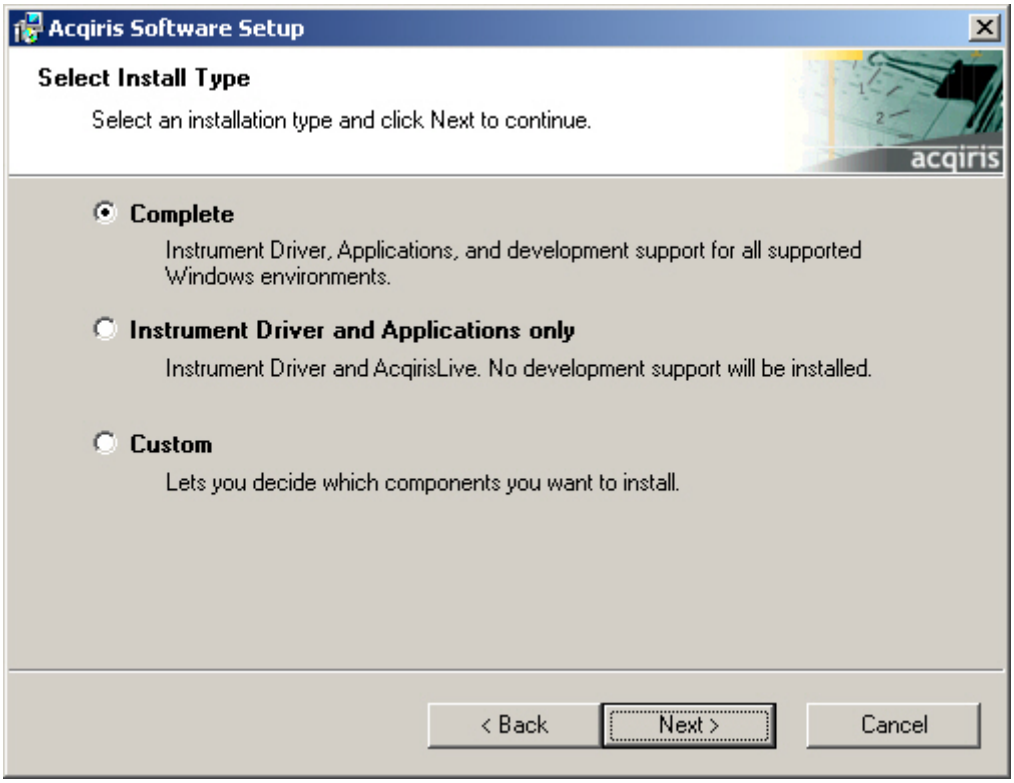

Acqiris Software Setup
Install Manuals
Make your choice below and click Next to continue.
acqiris
Please check the box below if you want access to Acqiris Manuals on your system (copy to disk and create shortcuts). All of the available User and Reference Manuals will be installed.
Enable Documentation Installation
< Back
Next >
Cancel

7. The screen above will normally allow the documentation to be installed. Remove the check from the box if you do not want online access to the manuals.

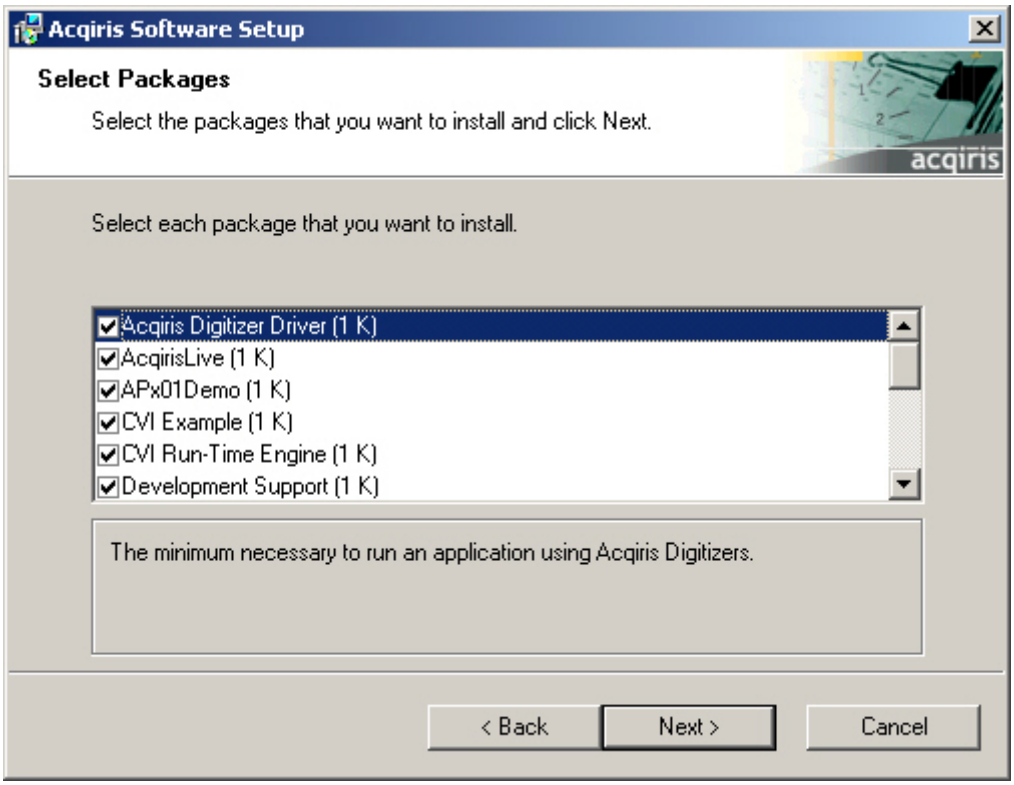
8. The next two screens allow you to enable PharLap and VxWorks Support. By default there will be none but if desired you can install either of them together with Windows support or without Windows support. Click "Next" to continue.


Acqiris Software Setup
Enable PharLAP ETS Support
Choose the ETS Driver if wanted, then click Next to continue.
acqiris
No PharLAP Support
Windows Support will be installed
PharLAP ETS + Windows Support
Installs the Drivers for PharLAP ETS. The sample programs will be installed if this box is checked and "Complete" installation is requested.
PharLAP ETS ONLY
Driver and Development support for PharLAP ETS. No Windows applications nor Windows application support.
< Back
Next >
Cancel

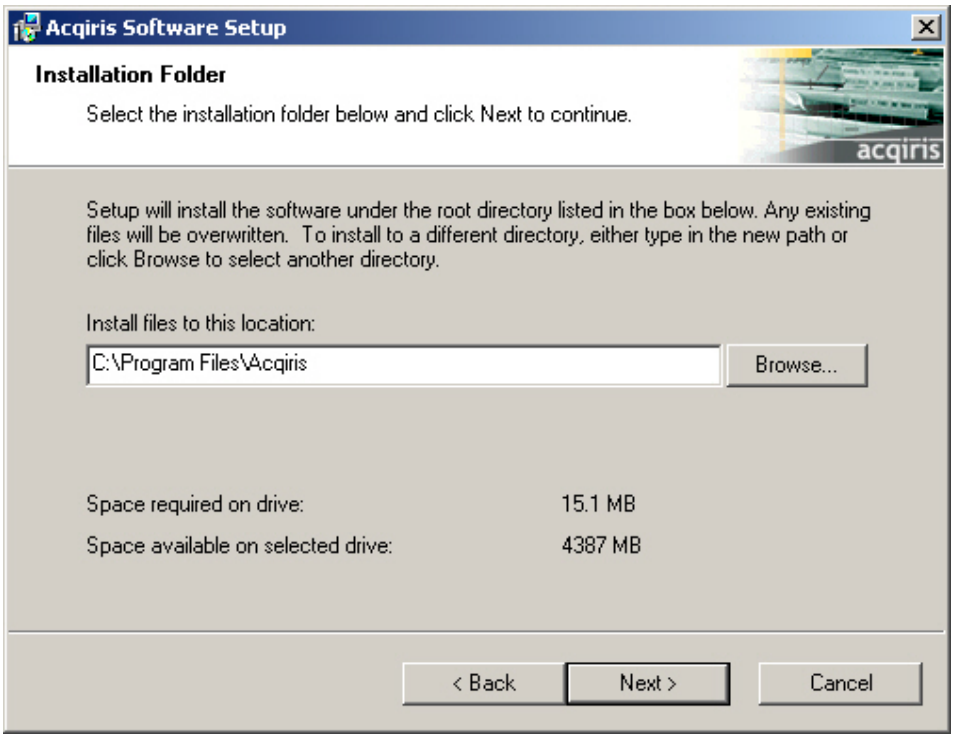
9. The screen below asks for the desired installation type. After having made your choice Click “Next” to continue.


Acqiris Software Setup
Select Install Type
Select an installation type and click Next to continue.
acqiris
Complete
Instrument Driver, Applications, and development support for all supported Windows environments.
Instrument Driver and Applications only
Instrument Driver and AcqirisLive. No development support will be installed.
Custom
Lets you decide which components you want to install.
< Back
Next >
Cancel

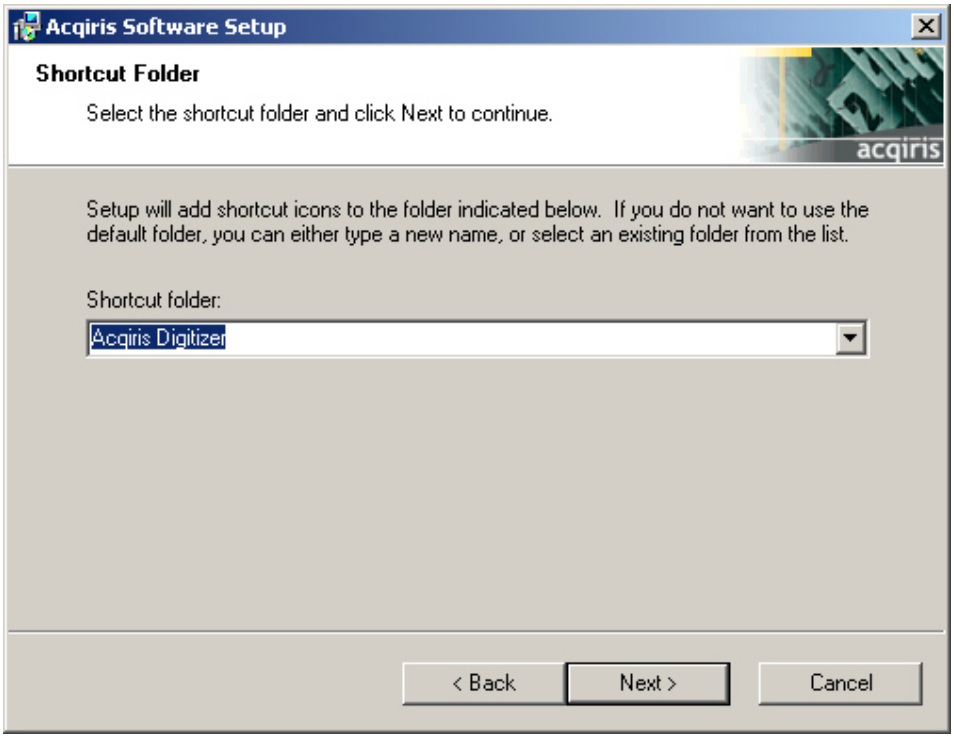
10. If you chose the Custom installation, the following screen will let you select each package individually. Note that the space indicated for LabVIEW, Firmware and UserManual packages is incorrect. The correct values are 3.5 MB, 6.0 MB, and 25.5 MB respectively.


Acqiris Software Setup
Select Packages
Select the packages that you want to install and click Next.
acqiris
Select each package that you want to install.
Acqiris Digitizer Driver (1 K)
AcqirisLive (1 K)
APx01Demo (1 K)
CVI Example (1 K)
CVI Run-Time Engine (1 K)
Development Support (1 K)
The minimum necessary to run an application using Acqiris Digitizers.
< Back
Next >
Cancel

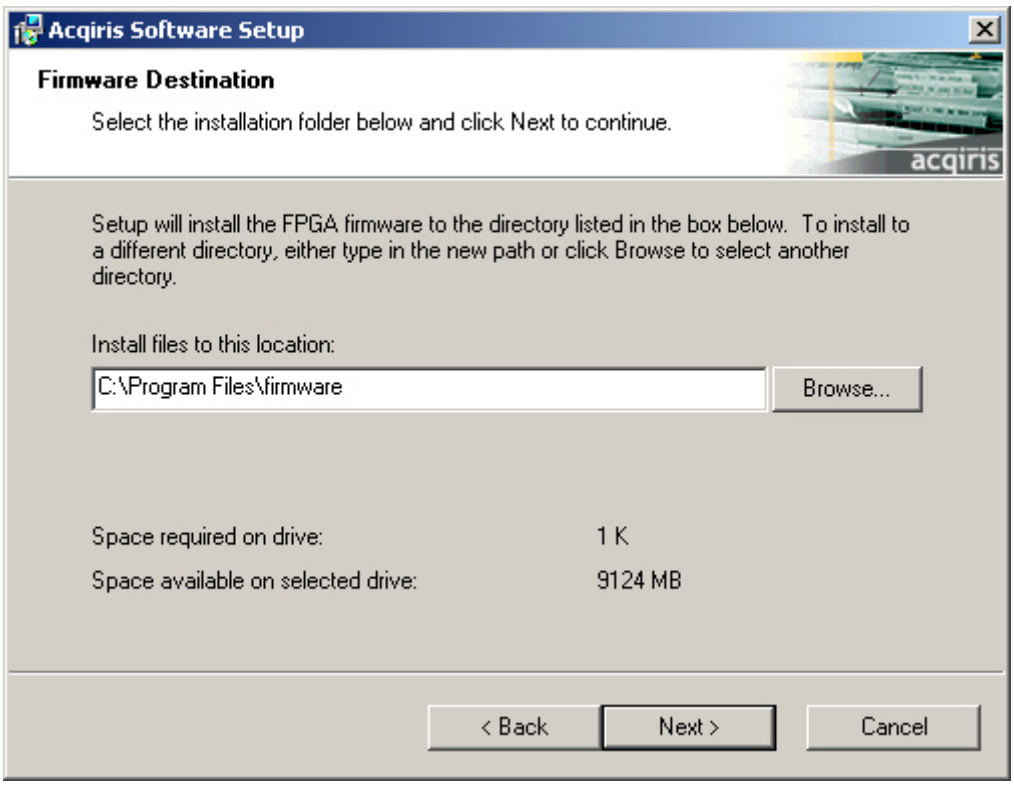
11. If MATLAB is installed on your machine, you will be asked to point the installer to the MATLAB root directory. You should do this if you want the installer to modify the standard startup.m file to incorporate the Acqiris adaptor.
12. Now that the elements of the installation have all been decided you will be prompted for the installation folder. This will be the root directory of the Acqiris software installation. If User Manuals (26 MB) and Firmware (6.0 MB) are loaded more space than indicated here will be required on the drive. For the case of a Tornado 2.2 installation the folder name should not contain any spaces.


Acqiris Software Setup
Installation Folder
Select the installation folder below and click Next to continue.
acqiris
Setup will install the software under the root directory listed in the box below. Any existing files will be overwritten. To install to a different directory, either type in the new path or click Browse to select another directory.
Install files to this location:
C:\Program Files\Acqiris
Browse...
Space required on drive: 15.1 MB
Space available on selected drive: 4387 MB
< Back
Next >
Cancel

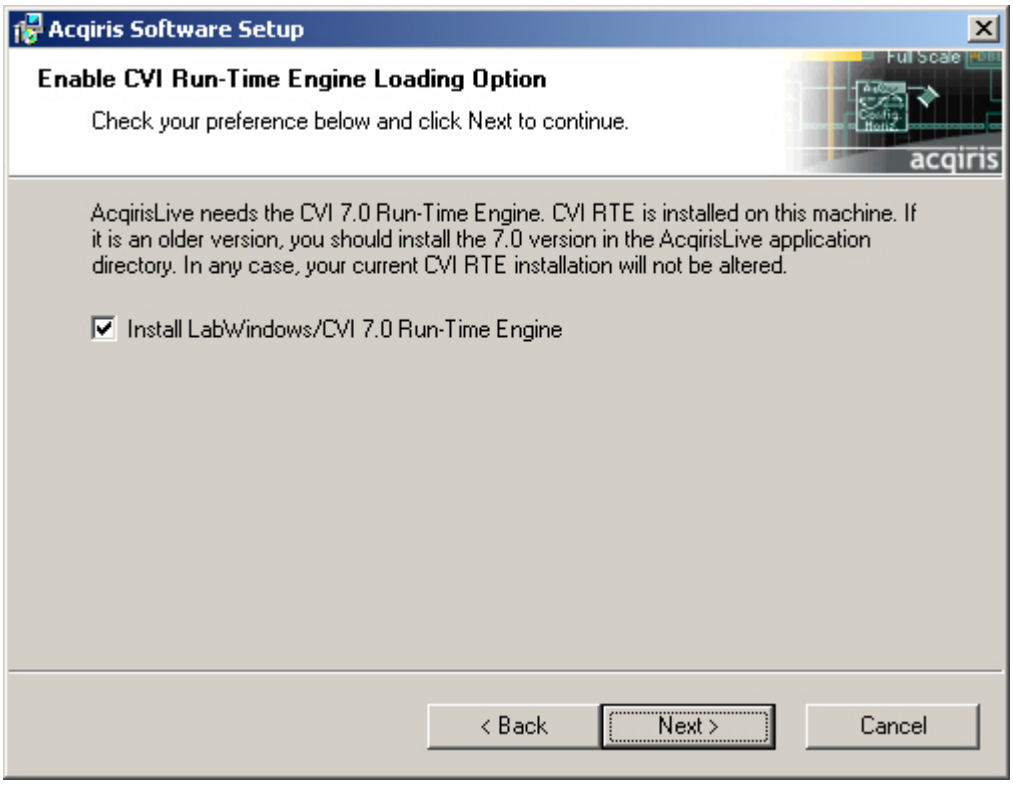
13. Furthermore, you should give a name to the shortcut folder. This is the menu entry under **Start** → Programs where you will find the shortcuts for AcqirisLive, manual(s), etc.


Acqiris Software Setup
Shortcut Folder
Select the shortcut folder and click Next to continue.
acqiris
Setup will add shortcut icons to the folder indicated below. If you do not want to use the default folder, you can either type a new name, or select an existing folder from the list.
Shortcut folder:
Acqiris Digitizer
< Back
Next >
Cancel

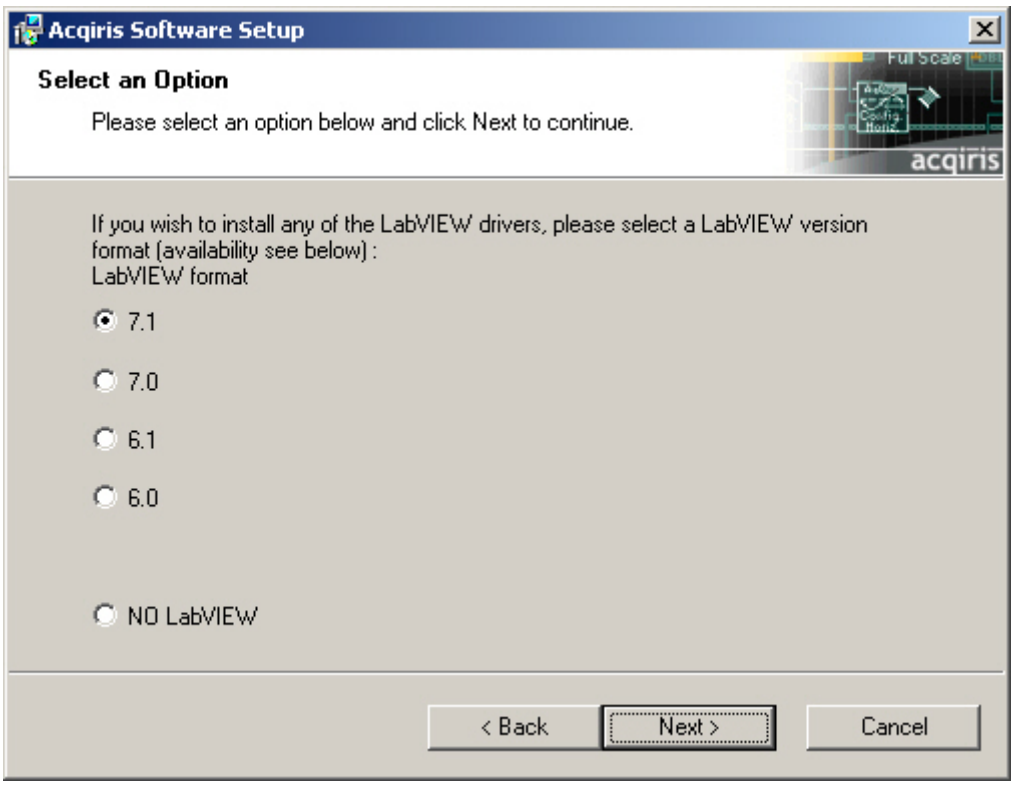
14. If you have enabled the installation of 12-bit Digitizers, Averagers, or Analyzers, the next screen lets you change the name of the directory where the FPGA firmware will be installed.


Acqiris Software Setup
Firmware Destination
Select the installation folder below and click Next to continue.
acqiris
Setup will install the FPGA firmware to the directory listed in the box below. To install to a different directory, either type in the new path or click Browse to select another directory.
Install files to this location:
C:\Program Files\firmware
Browse...
Space required on drive:
1 K
Space available on selected drive:
9124 MB
< Back
Next >
Cancel

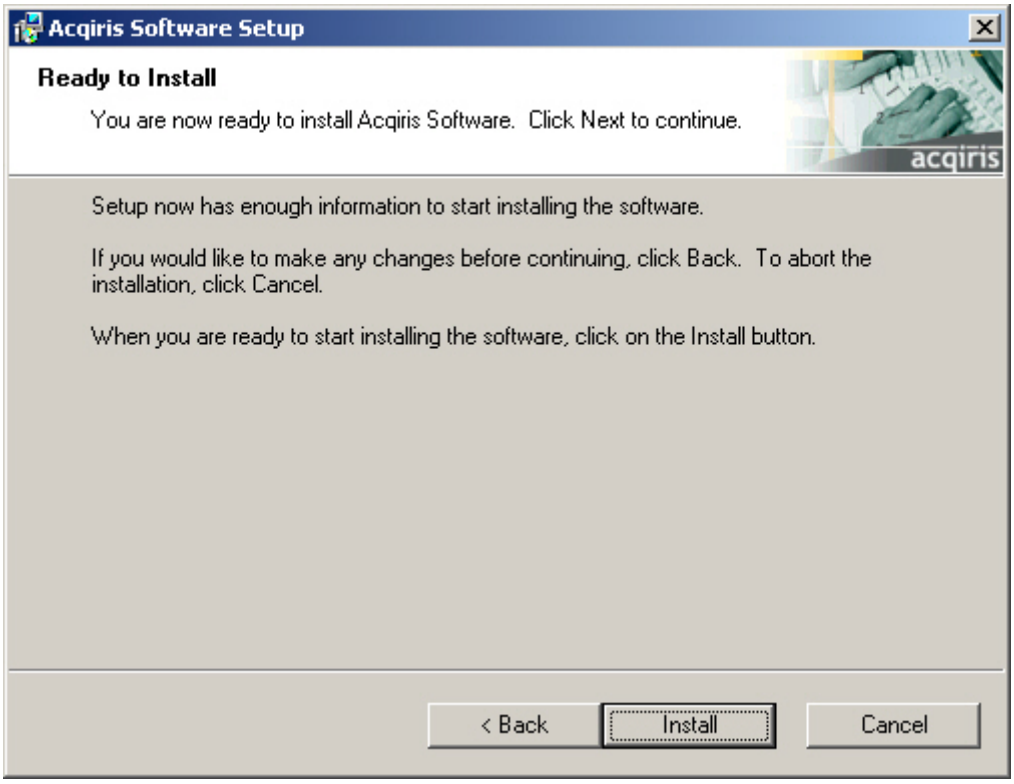
15. AcqirisLive needs the LabWindows/CVI 7.0 Run-Time Engine to run. If Setup has detected that a LabWindows/CVI Run-Time Engine is already installed on your system, it will ask you if you would like to install it locally for AcqirisLive anyway. If you are not sure about the version of the CVI Run-Time Engine on your system, it is recommended to install it locally. Click "Next" to continue.


Acqiris Software Setup
Enable CVI Run-Time Engine Loading Option
Check your preference below and click Next to continue.
acqiris
AcqirisLive needs the CVI 7.0 Run-Time Engine. CVI RTE is installed on this machine. If it is an older version, you should install the 7.0 version in the AcqirisLive application directory. In any case, your current CVI RTE installation will not be altered.
Install LabWindows/CVI 7.0 Run-Time Engine
< Back
Next >
Cancel

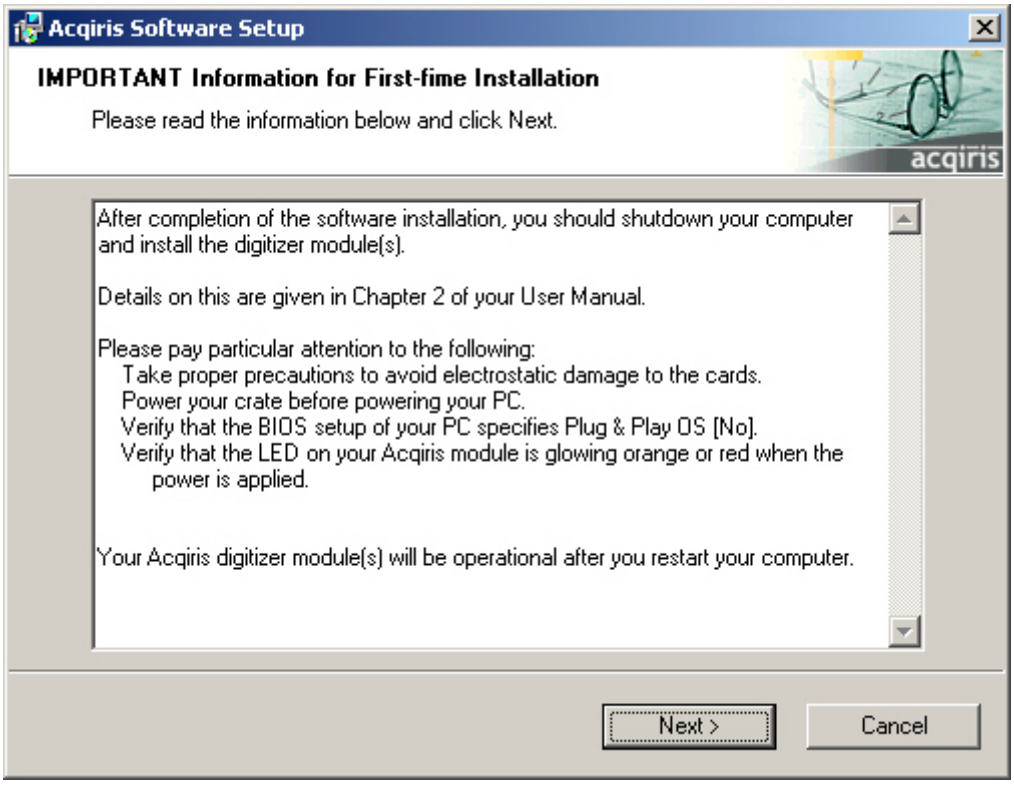
16. Depending on the install type, you may be asked which LabVIEW version format you want for the LabVIEW files. Select the appropriate format and click “Next” to continue.



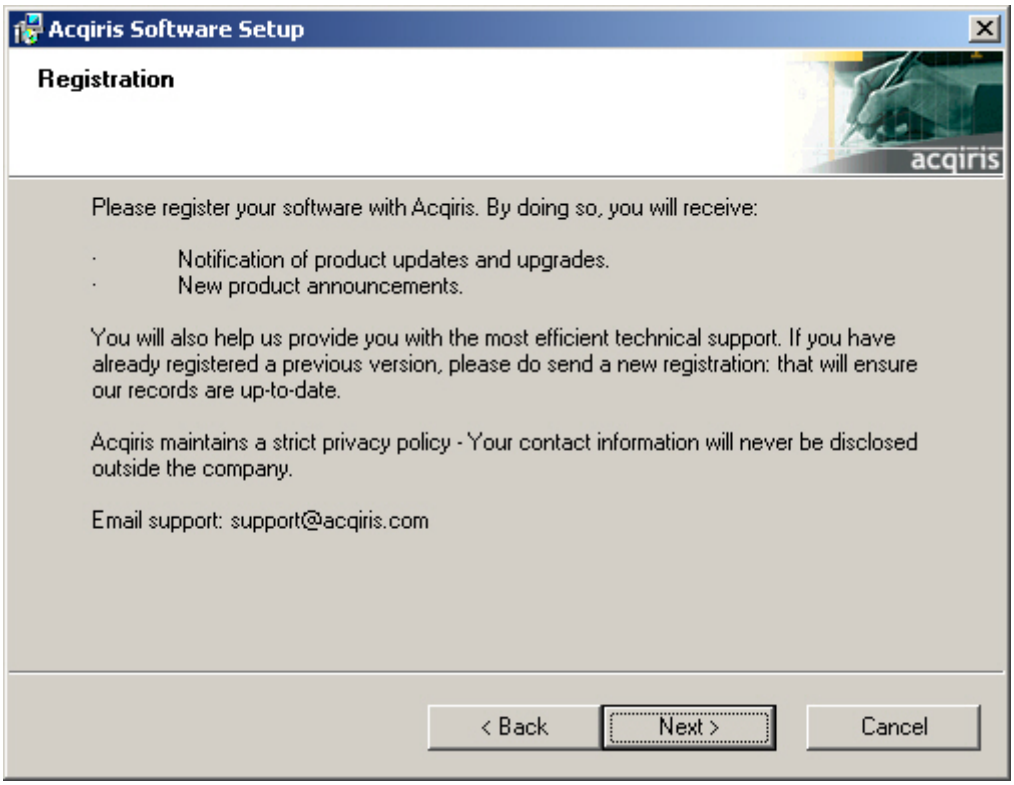
17. You are now ready to install. You may still go back to any previous screen to modify your selection. Click “Install” when ready.

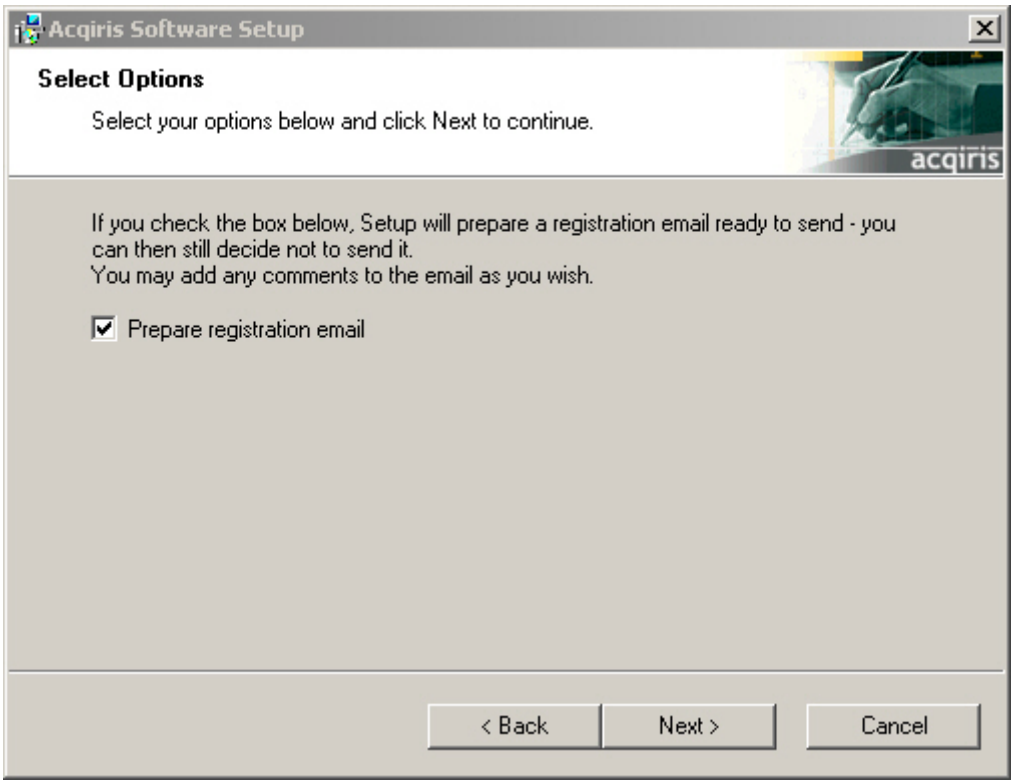

Acqiris Software Setup
Ready to Install
You are now ready to install Acqiris Software. Click Next to continue.
acqiris
Setup now has enough information to start installing the software.
If you would like to make any changes before continuing, click Back. To abort the installation, click Cancel.
When you are ready to start installing the software, click on the Install button.
< Back
Install
Cancel

18. Setup will now copy the files and make the necessary changes to your system. When done, an information screen will be displayed. Please read this carefully.


Acqiris Software Setup
IMPORTANT Information for First-fime Installation
Please read the information below and click Next.
acqiris
After completion of the software installation, you should shutdown your computer and install the digitizer module(s).
Details on this are given in Chapter 2 of your User Manual.
Please pay particular attention to the following:
Take proper precautions to avoid electrostatic damage to the cards.
Power your crate before powering your PC.
Verify that the BIOS setup of your PC specifies Plug & Play OS [No].
Verify that the LED on your Acqiris module is glowing orange or red when the power is applied.
Your Acqiris digitizer module(s) will be operational after you restart your computer.
Next >
Cancel

19. Registration of your installation will help us provide you with better support. You will also be notified of updates and upgrades. All information submitted to Acqiris will be treated confidentially and never be disclosed outside the company.


Acqiris Software Setup
Registration
acqiris
Please register your software with Acqiris. By doing so, you will receive:
· Notification of product updates and upgrades.
· New product announcements.
You will also help us provide you with the most efficient technical support. If you have already registered a previous version, please do send a new registration: that will ensure our records are up-to-date.
Acqiris maintains a strict privacy policy - Your contact information will never be disclosed outside the company.
Email support: support@acqiris.com
< Back
Next >
Cancel


Acqiris Software Setup
Select Options
Select your options below and click Next to continue.
acqiris
If you check the box below, Setup will prepare a registration email ready to send - you can then still decide not to send it.
You may add any comments to the email as you wish.
Prepare registration email
< Back
Next >
Cancel

20. Setup will prepare a registration e-mail in your e-mail client application upon termination of the setup procedure. You can then decide whether or not you wish to send it. You may also add comments. Uncheck the box if you do not want to register your installation.

21. Click “Finish”. The software installation is now complete.
22. You should now shutdown your computer and proceed with the hardware installation.

2.2. Installing the Software for Linux

The Acqiris Software is ready to install and run on Linux systems with either **RedHat versions 8.0 (Kernel Version 2.4.18)** or **9.0 (Kernel Version 2.4.20)**, or **Debian (Kernel Version 2.4.25)**. The driver and the library were compiled under **Debian** with **GNU gcc 3.3**. The Kernel Driver source code is available for recompilation for users with other Linux systems.

The tar file **AcqirisLinux.bz2** should be copied to a local directory (e.g. your home directory) and then unpacked by using the following command

```
tar xjf AcqirisLinux.bz2
```

The resulting directory **AcqirisLinux** contains an install script **drv-install** and a graphical Demo program **demo/AcqirisDemo**.

Before installing the driver you have to put the correct version of the Kernel mode driver into acqirisPCI.o. By default the version 2.4.18 RH8 is ready. If this is not what is needed type

```
cp lib/modules/acqrsPCI.o[.n] lib/modules/acqrsPCI.o
```

where the driver is from the following list

acqrsPCI.o.2.4.18	for Kernel Version 2.4.18 and RH8
acqrsPCI.o.2.4.20	for Kernel Version 2.4.20 and RH9
acqrsPCI.o.2.4.25	for Kernel Version 2.4.25 and Debian

To install the driver and the load script to the system, you have to get super user privileges and execute the driver install script by typing,

```
cd AcqirisLinux
./drv-install add
```

You can check that the driver is loaded properly with **`lsmod`** or **`dmesg`**. The **drv-install** script has the following additional functionality:

drv-install rem to remove the driver and load script

drv-install res to restart the driver

If you intend to use an Averager, an Analyzer, or a 12-Bit Digitizer you must install the Firmware .bit files. You can either copy them from the Firmware directory of the CD-ROM or download them from our WEB site. They should be placed in the Firmware subdirectory of AcqirisLinux. In the case of the CD-ROM, this can be done by continuing the above command sequence with the following:

```
cp /mnt/CDRom/Firmware/*.bit Firmware/
```

2.2.1. Kernel Mode Driver Compilation

For some special 2.4 kernels, for example SMP, the kernel mode driver will have to be recompiled on the target system. All files needed to compile a new kernel mode driver are in AcqirisLinux/linuxdriverpci.

The makefile can be used for compilation under a Redhat compatible distribution. To compile the driver, the kernel header files need to be installed. The path variable INCLUDEDIR in the Makefile has to point to the correct kernel header files. The default path INCLUDEDIR = /usr/src/linux-2.4. This path usually is a link to the actual header files (driver source).

To compile for a new kernel, issue the following commands:

- **cd linuxdriverpci**
- **make clean** to remove all *.o files in AcqirisLinux/linuxdriverpci.
- **make** to generate a new kernel mode driver acqrsPCI.o and also copy it to the directory AcqirisLinux/lib/modules where the install script (drv_install) can access it.
- **drv_install rem** to remove the previous installed kernel mode driver.
- **drv_install add** to install the new driver.

2.2.2. Special cases

If you are running a Linux distribution that doesn't use the standard paths for the load scripts, you can load the driver with the command

```
cd AcqirisLinux
./drv-install load
```

Copy the driver to the module directory as follows:

```
cp lib/modules/acqrsPCI.o[.n] /lib/modules/{kv}/ACQIRIS/acqrsPCI.o
```

where [.n] is the optional designation of the desired version of the acqrsPCI driver as given above and {kv} is the appropriate system kernel version (i.e. 2.4.20).

Then add the following command to **rc.local**.

/sbin/insmod –f /lib/modules//{kv}/ACQIRIS/acqrsPCI.o

2.2.3. Environment variables for the Firmware

Automatic loading of the firmware needed by 12-bit and AP modules relies on the environment variable **AcqirisDxDir** pointing to the directory containing the file **AqDrv4.ini** which in turn points to the directory containing the Firmware **.bit** files. Therefore, assuming that your Firmware is in **/usr/local/AcqirisLinux/Firmware** and that **AqDrv4.ini** is in **/usr/local/AcqirisLinux/demo** then you must edit **AqDrv4.ini** so that it contains the line

fpgaPath=/usr/local/AcqirisLinux/Firmware

Then, if your shell is **csh** or **tcsh** modify the **/etc/csh.login** file to contain the line

setenv AcqirisDxDir /usr/local/AcqirisLinux/demo

or, if your shell is **bash, ksh, zsh** or **sh**, modify the **/etc/profile** file to contain the lines

AcqirisDxDir=/usr/local/AcqirisLinux/demo

export AcqirisDxDir

2.3. Installing the Hardware

1. Turn off the power of the PC and the crate in the case of a CompactPCI module. However, leave them plugged in to ensure proper grounding.

⚠ ***CAUTION:*** ***Touch the antistatic package to a grounded metal part of the PC or crate before removing the card from the package. Electrostatic discharge can damage the card.***

2. Module in a PC: open the PC, identify a free PCI slot and carefully insert the DP Series card into it. Be sure to ground yourself by touching the grounded PC frame and avoid touching any components on the DP Series card. Make sure that the grounding of the card's mounting bracket to the back panel rail of the computer is done correctly. If present make sure that the fan's adjustable retainer is correctly positioned and tightened for mechanical support. Close the PC.

   Module in a CompactPCI crate: Follow the instructions of the crate manufacturer to insert the DC Series card into a free 6U CompactPCI peripheral slot. Be sure to ground yourself by touching the grounded crate and avoid touching any components on the DC Series card. Be sure to tighten both front panel mounting screws to lock the module into place and insure proper grounding of the frame.

⚠ ***NOTE:*** *To ensure the best possible performance, users of Acqiris CC121 Crates with ASBus systems should respect the module placement rules to be found in the Acqiris CC121 CompactPCI Crate User Manual.*

   PCI Bus extension module in a PC: Consult the manufacturer's documentation for any special instructions. Open the PC, identify a free PCI slot and carefully insert the card into it. Be sure to ground yourself by touching the grounded PC frame and avoid touching any components on the card. Make sure that the grounding of the card's mounting bracket to the back panel rail of the computer is done correctly. Close the PC. Connect the module to the CompactPCI crate controller.

3. Turn on the power of the crate(s), if present, and then the PC and start the operating system.

⚠ ***NOTE:*** *Acqiris Digitizers are equipped with a LED. If this LED is not glowing orange or red when the power is applied there is a severe problem. Either the module is broken or the necessary voltages for its use are not available.*

⚠ ***NOTE:*** *For proper system operation when using the IC200 or other PCI extension interface from Acqiris to connect a CC10X crate to a remote PC, the crate* ***must*** *be powered on before the PC in order for the PC BIOS to recognize the presence of the CompactPCI crate.*

4. Go into the *BIOS Setup* menu. Under the *Advanced* section or the *Boot* section you may find a selection named Plug & Play OS. Check that its value is [No]. If it is not you should change it to this value and save the settings.

⚠ ***NOTE:*** *For proper system operation the Acqiris Driver expects that the BIOS has already configured any modules present. Plug & Play OS [Yes] inhibits this activity and can result in the Acqiris hardware not being recognized.*

2.4. After Restarting

2.4.1. Windows 95

Under Windows95, the first time the system is started, the Plug&Play system will automatically detect the Acqiris hardware and briefly display a **New Hardware Found** dialog box prior to automatically installing the new hardware.

2.4.2. Windows 98

Under Windows98, the first time the system is started, the Plug&Play system will automatically detect the Acqiris hardware, briefly display a **New Hardware Found** dialog box and start the "Add New Hardware Wizard" displaying the window shown below.

Add New Hardware Wizard
This wizard searches for new drivers for:
PCI Card
A device driver is a software program that makes a hardware device work.
< Back
Next >
Cancel

To proceed with the installation click "Next". The following window will appear.

Add New Hardware Wizard
What do you want Windows to do?
Search for the best driver for your device. (Recommended).
Display a list of all the drivers in a specific location, so you can select the driver you want.
< Back
Next >
Cancel

To proceed with the installation click “Next”. The following window will appear.

Add New Hardware Wizard
Windows will search for new drivers in its driver database on your hard drive, and in any of the following selected locations. Click Next to start the search.
Floppy disk drives
CD-ROM drive
Microsoft Windows Update
Specify a location:
C:\WINDOWS\INF
Browse...
< Back
Next >
Cancel

To proceed with the installation, keep the defaults and click “Next”. The following window will appear.

Add New Hardware Wizard
Windows driver file search for the device:
Acqiris DCxxx/DPxxx Digitizer
Windows is now ready to install the best driver for this device. Click Back to select a different driver, or click Next to continue.
Location of driver:
C:\WINDOWS\INF\ACQIRV02.INF
< Back
Next >
Cancel

To proceed with the installation click “Next”. The following window will appear.

Click “Finish” and the hardware installation will be complete.

2.4.3. Windows 2000

Under Windows 2000, you *must* login with administrator privileges after the first boot following the hardware installation; the Plug&Play system must have the appropriate privileges to be able to complete your hardware installation successfully. After a successful hardware installation, you will be able to use your Acqiris Digitizer(s) with normal privileges.

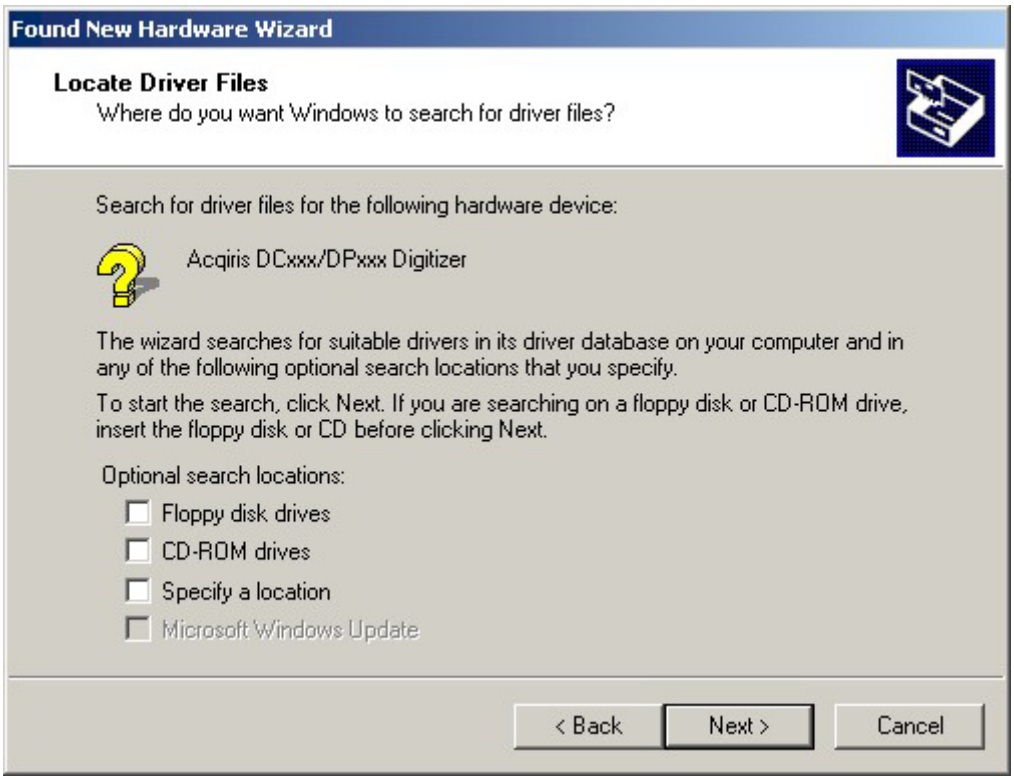
If you login with administrator privileges after the first boot following the hardware installation, Windows will detect the new hardware and start the “Found New Hardware Wizard” after a few seconds.

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install a device driver for a hardware device.
To continue, click Next.
< Back
Next >
Cancel

To proceed with the installation click “Next”. The following window will appear.

Found New Hardware Wizard
Install Hardware Device Drivers
A device driver is a software program that enables a hardware device to work with an operating system.
This wizard will complete the installation for this device:
Acqiris DCxxx/DPxxx Digitizer
A device driver is a software program that makes a hardware device work. Windows needs driver files for your new device. To locate driver files and complete the installation click Next.
What do you want the wizard to do?
Search for a suitable driver for my device (recommended)
Display a list of the known drivers for this device so that I can choose a specific driver
< Back
Next >
Cancel

To proceed with the installation click “Next”. The following window will appear.


Found New Hardware Wizard
Locate Driver Files
Where do you want Windows to search for driver files?
Search for driver files for the following hardware device:
Acqiris DCxxx/DPxxx Digitizer
The wizard searches for suitable drivers in its driver database on your computer and in any of the following optional search locations that you specify.
To start the search, click Next. If you are searching on a floppy disk or CD-ROM drive, insert the floppy disk or CD before clicking Next.
Optional search locations:
Floppy disk drives
CD-ROM drives
Specify a location
Microsoft Windows Update
< Back
Next >
Cancel

To proceed with the installation click “Next”.

Found New Hardware Wizard
Driver Files Search Results
The wizard has finished searching for driver files for your hardware device.
The wizard found a driver for the following device:
Acqiris DCxxx/DPxxx Digitizer
Windows found a driver for this device. To install the driver Windows found, click Next.
d:\winnt\inf\acqirv02.inf
< Back
Next >
Cancel

To proceed with the installation click “Next”. The following window will appear.

Found New Hardware Wizard
Completing the Found New Hardware Wizard
Acqiris DCxxx/DPxxx Digitizer
Windows has finished installing the software for this device.
To close this wizard, click Finish.
< Back
Finish
Cancel

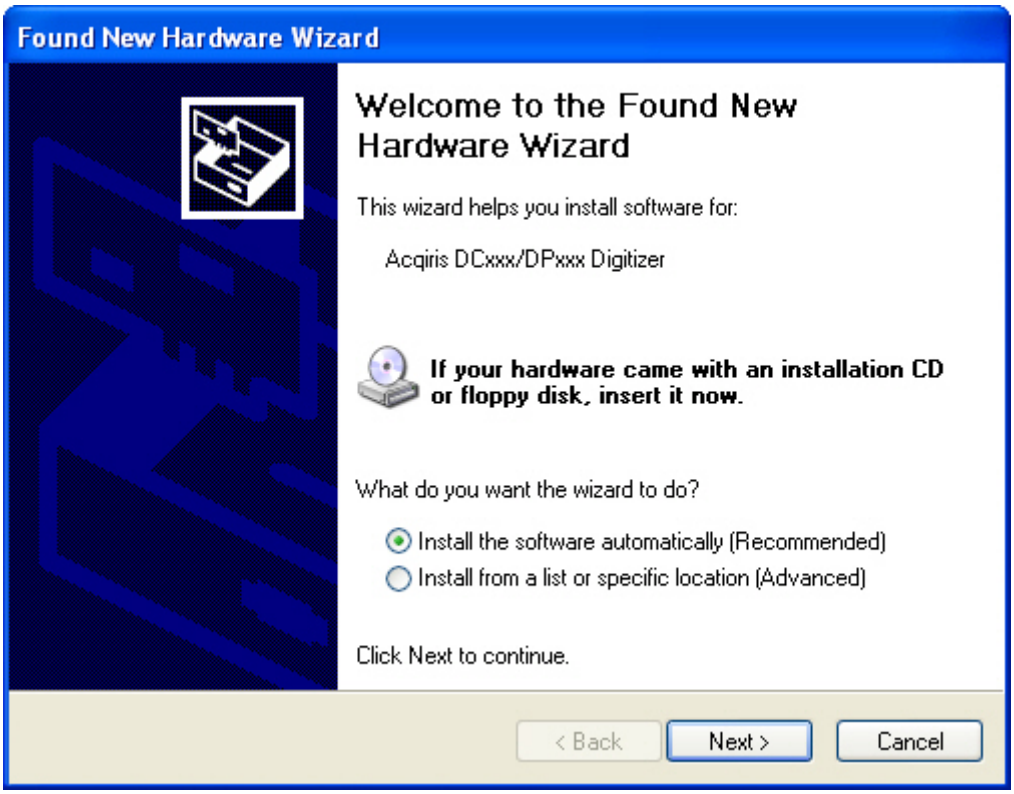
Click “Finish” and the hardware installation will be complete.

2.4.4. Windows XP

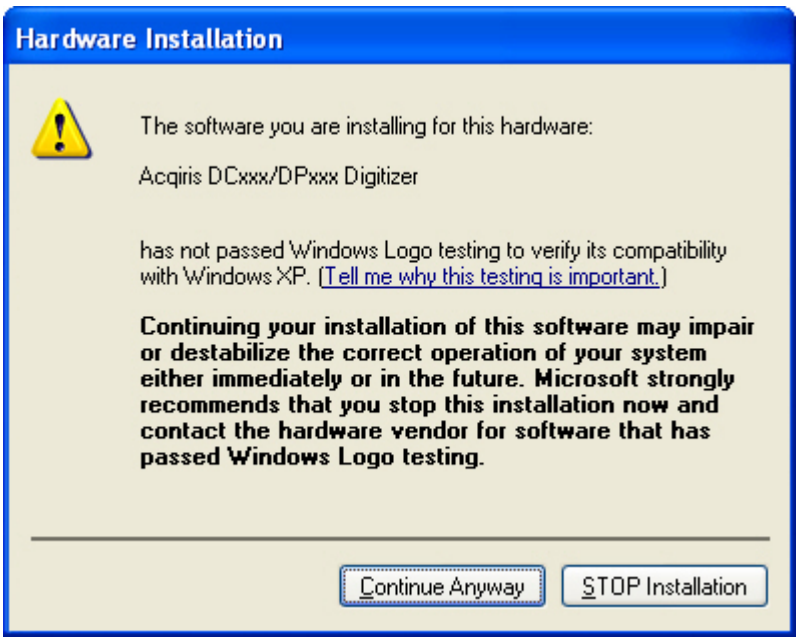
Under Windows XP, you *must* login with administrator privileges after the first boot following the hardware installation; the Plug&Play system must have the appropriate privileges to be able to complete your hardware installation successfully. After a successful hardware installation, you will be able to use your Acqiris Digitizer(s) with normal privileges.

If you login with administrator privileges after the first boot following the hardware installation, Windows will detect the new hardware and start the “Found New Hardware Wizard” after a few seconds.

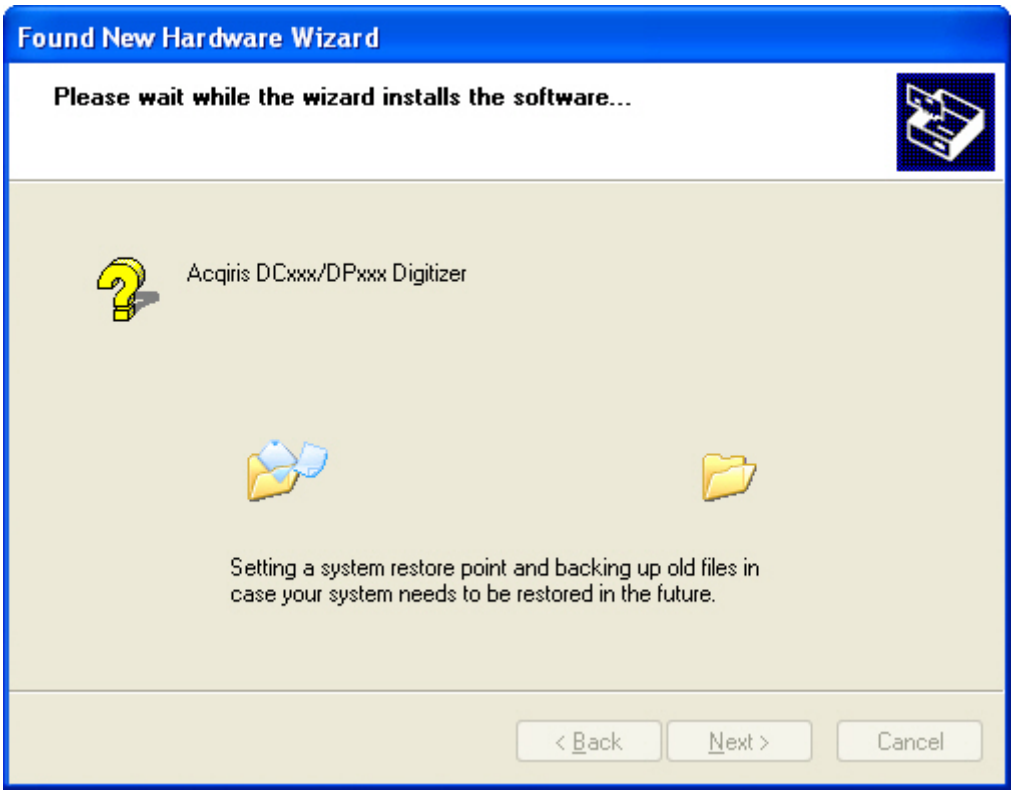
⚠ ***NOTE:*** *Acqiris Digitizers and the drivers provided to not support the* ***Standby*** *mode. You may want to de-activate this feature if it is in use on your PC. An error message will occur if the transition into* ***Standby*** *mode is attempted.*


Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install software for:
Acqiris DCxxx/DPxxx Digitizer
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

To proceed with the installation click "Next". In the case of **Windows XP** with the **Driver Signing Options** action set to **Warn** the following window will appear:


Hardware Installation
The software you are installing for this hardware:
Acqiris DCxxx/DPxxx Digitizer
has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)
Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.
Continue Anyway
STOP Installation

You can safely tell the computer to **Continue Anyway.** You should then see


Found New Hardware Wizard
Please wait while the wizard installs the software...
Acqiris DCxxx/DPxxx Digitizer
Setting a system restore point and backing up old files in case your system needs to be restored in the future.
< Back
Next >
Cancel

and then

⚠ ***NOTE:*** *In some systems an application program (such as AcqirisLive) will not yet work correctly at this point. One additional boot cycle may be needed if this is the first time that a hardware board is being installed.*

2.4.5. Windows NT 4.0

Under Windows NT 4.0, the operating system does not automatically detect new hardware. However, the Acqiris device drivers are configured to automatically search for all Acqiris devices present on the system when the NT driver is started. Therefore the system is ready to run immediately after booting the computer.

2.4.6. MATLAB

The Acqiris Adaptor has to be registered. This can be done with the following command:

```
>> Aq_Install
```

This command will also generate diagnostic information that confirms that the installation succeeded. Since a calibration will be performed the command may take a while to execute. If no errors are shown the CallAcqiris.dll file was successfully installed. You should see messages like this:

```
Registering the Acqiris Adaptor... 'aq.dll' successfully registered.
        AdaptorDllName: 'C:\Program Files\Acq2.13a\bin\aq.dll'  Location
        AdaptorDllVersion: '1, 0, 5, 12'   DLL Version
        AdaptorName: 'aq'
        BoardNames: {'DP240[12767]'}       Either  Model [Serial Number]
                                           or {1xn cell}
        InstalledBoardIds: {'0'}           Board Identifiers for MATLAB
    ObjectConstructorName: {'analoginput('aq','0')'  ''  ''}
                                           or {nx3 cell}
Help for CallAcqiris module
Syntax: CallAcqiris('FunctionName', ArgIn, ..., ArgOut, ...)
List of available functions from this module:
     CallAcqiris('SetString', instID, 'attribute', 'string') {Set an
                    attribute value (String)}
```

Followed by more help lines and the next command prompt.

If there is an error, please check your paths under MATLAB and contact us if needed.

2.5. Distribution for Windows 95 / 98 / NT4 / 2000 / XP

After a complete installation of Acqiris Software for Windows (supports Windows 95/98/NT4/2000/XP), the following files and directories should exist in the chosen installation directory:

- **irunin.*** miscellaneous install files
- **AcqirisApp** directory:
  - **AcqirisLive.exe** AcqirisLive Windows application
  - **AP_SSRDemo.exe** AP SSRDemo application
  - **APx01Demo.exe** APx01Demo application
  - **GeoMapper.exe** Acqiris GeoMapper application
  - **cviauto.dll** NI software needed by AcqirisLive
  - **cvirt.dll** NI software needed by AcqirisLive
  - **cvirte.dll** NI software needed by AcqirisLive
  - **dataskt.dll** NI software needed by AcqirisLive
  - **mesa.dll** software needed by AcqirisLive
  - **cvirte** directory containing **bin** and **fonts** subdirectories
  - **Data** directory to be used for saved data files from AcqirisLive or APx01Demo

- **Bin** directory:
  - **aq.dll** software needed by MATLAB Adaptor
  - **AqDrv4.dll** Acqiris Windows Digitizer Driver DLL
  - **AqDrv4.fp** CVI function panel: contains all the driver C-functions
  - **AqDrv4.ini** Optionally created to indicate where FPGA .bit files can be found.
  - **AqISl3.dll** software needed by AcqirisLive and MATLAB Adaptor
  - **AqSCl3.dll** software needed by AcqirisLive and MATLAB Adaptor
  - **CallAcqiris.dll** software needed by MATLAB Adaptor
  - **InstrumentSettings.AqSettings** MATLAB Instrument Settings Configuration file
  - **msvcp71.dll** Microsoft VC run-time
  - **msvcr71.dll** Microsoft VC run-time
  - **qt-mt310.dll** software needed by AcqirisLive and MATLAB Adaptor
  - **qt-mt332.dll** software needed by AcqirisLive and MATLAB Adaptor
- **Bin\kernel** directory:
  - **acqirv00.vxd** Win9x low level driver
  - **acqirv03.inf** Win9x/2000 low level driver
  - **Acqir400.sys** WinNT4 low level driver
  - **Acqir500.sys** Win2000 low level driver
- **CVI** directory with the files needed for a LabWindows/CVI program:
  - **GetStarted.c** C source code of CVI sample program
  - **GetStarted.h** Header associated with the User Interface file of CVI sample program
  - **GetStarted.prj** LabWindows/CVI project file of CVI sample program
  - **GetStarted.uir** CVI User Interface file of CVI sample program
- **ETS** directory with the files need for a PharLAP ETS sample program
  - **GetStartedETS.cpp** C source code of ETS sample program
  - **GetStartedETS.dsp** VisualC++ 6.0 project file of ETS sample program
  - **GetStartedETS.dsw** VisualC++ 6.0 workspace file of ETS sample program
  - **GetStartedETS.lnk** ETS application linker file
  - **GetStartedETS.rc** VisualC++ 6.0 resource file of ETS sample program
  - **GetStartedETS.vsb** VisualSystemBuilderProject file of ETS sample program
  - **resource.h** Header associated with the resources for the ETS sample program
  - **RTOS.ini** ETS Configuration file
- **Firmware** directory containing FPGA **.bit** files for AP100, AP101, AP200, AP201, AP235, AP240, DP306, DP308, DP310, DC436, DC438, and DC440
- **Include** directory with:
  - **AcqirisD1Import.h** Header file for C/C++
  - **AcqirisD1Interface.h** Acqiris Device Driver Interface Definitions (API)
  - **AcqirisDataTypes.h** Data Structure Header file for C/C++
  - **AcqirisErrorCodes.h** Acqiris Error Code definitions
  - **AcqrsD1Interface.bas** Header file for Visual Basic
  - **AcqrsD1Interface.vb** Header file for Visual Basic .NET
  - **visatype.h** VISA types, already installed if you have LabWindows/CVI
  - **vpptype.h** already installed if you have LabWindows/CVI

- **Lib** directory with C/C++ link libraries for major compilers:
  - **AqDrv4.lib** default, Microsoft compiler
  - **borland\AqDrv4.lib** Borland compiler
  - **msvc\AqDrv4.lib** Microsoft compiler
  - **AqETS4.lib** PharLAP libraries
  - **AqLibETS.lib** PharLAP libraries
- **Manuals** directory with:
  - **AqDrv4.HLP** C driver help
  - **ProgrammersGuide.pdf**
  - **ProgrammersReferenceManual.pdf**
  - **ReadMe.txt** A user oriented ReadMe file with information about the installed software
  - ShortCutNames.txt needed for (Un)Install
  - **UserManual12BitDigitizers.pdf**
  - **UserManual8BitDigitizers.pdf**
  - **UserManualAnalyzers.pdf**
  - **UserManualAveragers.pdf**
  - **UserManualCC10XCrates.pdf**
  - **UserManualCC121Crate.pdf**
- **MATLAB** directory with:
  - **Aq_install.m** needed for registration and validation
  - **Aq_ModeLive.m** example
  - **Aq_MultipleAcquisition.m** example
  - **Aq_SingleAcquisition.m** example
  - **InstrumentSettings.AqSettings** MATLAB Instrument Settings Configuration file
  - **startup.m** example for use in Toolbox\local\startup.m
- **ReplacedSystemFiles** directory with old versions for possible recovery (not for Windows XP):
  - **msvcp60.dll**
  - **msvcrt.dll**
- **tornado** directory with sample program:
  - **GetStartedVxW.cpp** Source file for Tornado sample program
  - **GetStartedVxW.wpj** Tornado Project file for Tornado sample program
  - **GetStartedVxW.wsp** Tornado Workspace for Tornado sample program
- **VB** directory with the files needed for either a 12-bit digitizer or 8-bit digitizer Visual Basic program:
  - **AcqirisShow12.frm** Source code for main window of VB sample program
  - **AcqirisShow12.vbp** Visual Basic project file of VB sample program
  - **AcqirisShow12.vbw** VBW file of VB sample program
  - **AcqirisShow8.frm** Source code for main window of VB sample program
  - **AcqirisShow8.vbp** Visual Basic project file of VB sample program
  - **AcqirisShow8.vbw** VBW file of VB sample program
  - **DevCtrlForm12.frm** Source code for device control dialog box of VB sample program
  - **DevCtrlForm8.frm** Source code for device control dialog box of VB sample program

- **VC** directory with the files needed for either an averager or a digitizer VisualC++ program:
  - **GetStartedAvgVC.cpp** C++ source code of VC sample program
  - **GetStartedAvgVC.dsp** VisualC++ 6.0 project file of VC sample program
  - **GetStartedVC.cpp** C++ source code of VC sample program
  - **GetStartedVC.dsp** VisualC++ 6.0 project file of VC sample program
  - **GetStartedVC.rc** Resource file of VC sample program
  - **resource.h** Resource file of VC sample program
- **vxworks** directory with:
  - **AcqirisVxWUmode.out** AcqrsD1 VxWorks driver
  - **VxWorksDriverPCI.out** AcqrsD1 VxWorks Low Level driver
- **LabVIEW\help** directory with the help file needed for a LabVIEW program:
  - **AQDRV4.HLP**
- **LabVIEW\Instr.lib\AqDx** directory with the files needed for a LabVIEW program:
  - **acstat.mnu**
  - **applic.mnu**
  - **AqDx.llb**
  - **AqDx_u.llb**
  - **config.mnu**
  - **data.mnu**
  - **dir.mnu**
  - **util.mnu**
- ***"Windows "*** directory (Windows or WINNT)
  - **Acqiris Software Setup Log.txt** a readable record of installation activity
- ***"Windows system"*** directory (Windows\system or WINNT\system32)
  - **acqirv00.vxd** Win9x
  - **drivers\Acqir400.sys** NT4
  - **drivers\Acqir500.sys** Win2000
  - **msvcp60.dll** Microsoft VC run-time
  - **Msvcrt.dll** Microsoft VC run-time
- **"Windows" \Inf** directory (WINNT\Inf)
  - **acqirv03.inf** Win9x/2000

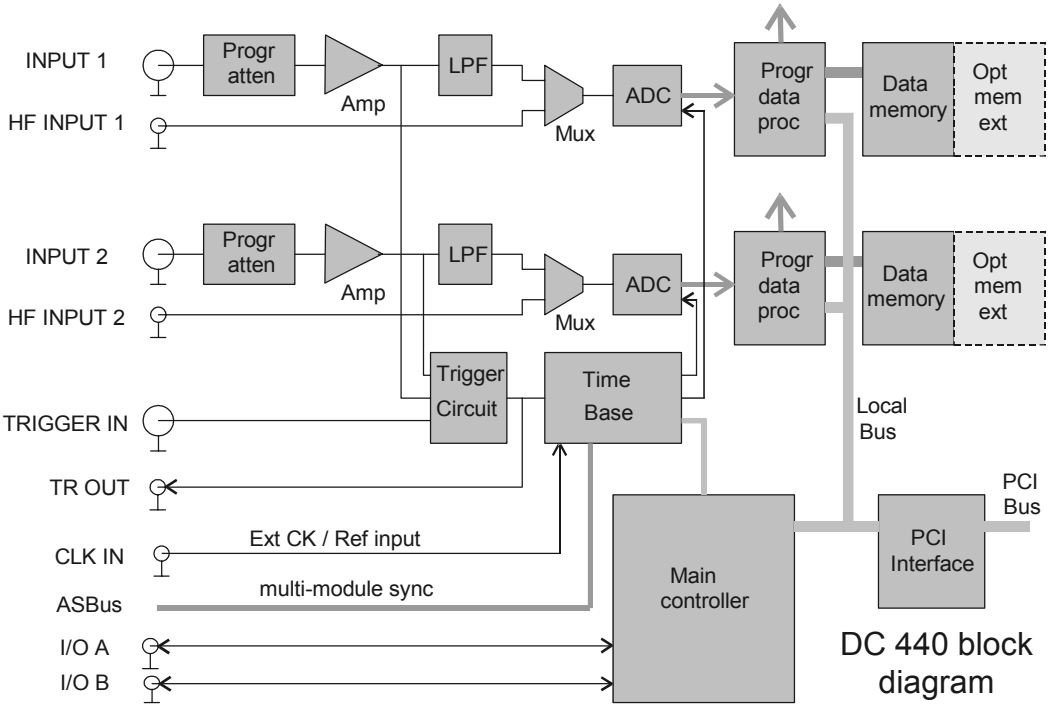
2.6. Distribution for Linux

- **AcqirisLinux** directory:
  - **drv-install** install script, creates system load script
  - **.acqstartstop** hidden file used by the install script
  - **demo** directory:
    - **AcqirisDemo** AcqirisDemo application, based on the Qt GUI
    - **libqt-mt.so.3** Qt 3.3.2 GUI library
    - **AqDrv4.ini** to indicate where FPGA .bit files can be found
  - **Firmware** directory containing FPGA **.bit** files

- **lib** directory:
  - **modules/acqrsPCI.o** the device driver for Kernel 2.4.18 or RH8
  - **modules/acqrsPCI.o.2.4.18** alternate driver for Kernel 2.4.18 or RH8
  - **modules/acqrsPCI.o.2.4.20** alternate driver for Kernel 2.4.20 or RH9
  - **modules/acqrsPCI.o.2.4.25** alternate driver for Kernel 2.4.25 or Debian
- **linuxdriverpci** directory:
  - **Makefile** to create acqrsPCI.o
  - **LinuxGeneral.h** header file
  - **DDrIORules.h** header file
  - **LinuxDriverPCI.c** kernel driver main source code
  - **LinuxDriverPCI.h** kernel driver header file
  - **LinuxConfigPCI.c** kernel driver configuration code
- **usr/include** directory:
  - **AcqirisD1Import.h** Header file for C/C++
  - **AcqirisD1Interface.h** Acqiris Device Driver Interface Definitions (API)
  - **AcqirisDataTypes.h** Data Structure Header file for C/C++
  - **AcqirisErrorCodes.h** Acqiris Error Code definitions
  - **visatype.h** VISA types
  - **vpptype.h**
- **usr/lib** directory:
  - **libAnDBSLib.a** Linux Acqiris library (compiled with gcc-3.2)
  - **libAqLib.a** Linux Acqiris base library
- **usr/src** directory:
  - **GetStarted** Linux sample program
  - **GetStartedc** Linux sample program
  - **GetStartedc.c** Linux sample program source
  - **GetStarted.cpp** Linux sample program source
  - **GetStarted.o** Linux sample program object
  - **Makefile** makefile to create the application

3. Product Description

3.1. Overview



Progr atten - Programmable attenuator

LPF - Low Pass Filter

Progr data proc - Programmable data processing

The Acqiris DC4xx Digitizer cards ((DC440, DC438, and DC436) are CompactPCI/PXI compliant and require an appropriate CompactPCI crate. The DP3xx digitizers (DP310, DP308, and DP306) are PCI modules that plug directly into a vacant PCI slot in a PC. The PCI Bus is a well-defined industry standard with a 32-bit bus operating at 33 MHz. The digitizers are fully programmable over the PCI bus and deliver oscilloscope-like performance. Data captured by the digitizers can be transferred to a host processor, either in the PC, in the crate, or interfaced to the crate, over the PCI bus, at speeds up to 100 Mbytes/s.

DC4xx digitizers occupy a single slot of a 6U CompactPCI crate and they comply with the 6U CompactPCI standard (PXI compliant).

Acqiris digitizers are designed to provide superior measurement precision and accuracy. Key acquisition specifications (such as DC accuracy, integral and differential non-linearity) have been optimized to deliver maximum measurement fidelity. Careful circuit layout, custom IC's and special packaging techniques have all been employed to reduce overall system noise. The use of custom IC's also dramatically reduces the total number of discrete components required. This has tremendous benefits on reliability and also allows the modules to use a minimal amount of power.

For complete technical specifications concerning your particular digitizer please refer to the product's Specifications & Characteristics. In addition, Acqiris maintains up-to-date versions of all product data sheets on our web site (www.acqiris.com). The data sheets are available in pdf format and are best viewed using Adobe Acrobat software. If you have trouble accessing our web site, or viewing the data sheets, please contact your nearest sales office.

3.2. Channel Input

3.2.1. Coupling & Impedance

The normal BNC input channels of all of the 12-bit digitizers provide a high quality DC coupled 50 Ω input impedance with better than ± 1% precision. They are ideally suited for use with 50 Ω transmission lines (coax), high bandwidth low impedance (typically 500 Ω) probes or active probes.

The Direct HF SMA inputs of the DC440 and DP310 are AC coupled at 50 Ω input impedance. The AC cutoff frequency is 1 MHz.

3.2.2. Input Protection

For the normal BNC inputs the amplifiers are protected against over-voltage signals. Input signals up to ±10 V DC or RMS can be input without damaging the front-end electronics.

The Direct HF inputs accept signals up to ±5 V DC or RMS without damaging the circuitry.

3.2.3. Mezzanine Front-end

The front-end electronics are all mounted on a removable mezzanine card. In the event of accidental damage, or as components fatigue over time (e.g. relays in high duty cycle automated testing applications), the mezzanine card allows for fast and efficient replacement.

3.2.4. Bandwidth and Rise Time

The bandwidth specification indicates the frequency at which an input signal will be attenuated by 3 dB (approximately 30% loss of amplitude). The bandwidth also affects the minimum rise and fall times that can be passed through the front-end electronics. A pulse with a very sharp edge will be observed to have a minimum rise time (τ_{min}) determined by the front-end electronics. In general a pulse with a given 10-90% rise time ($\tau_{10\text{-}90real}$) will be observed with a slower value given by:

$$\tau_{10\text{-}90}^2 = \tau_{10\text{-}90real}^2 + \tau_{min}^2$$

The following table indicates the bandwidth and rise time performance of 12-bit digitizers.

Model	Bandwidth into 50 Ω	Minimum Rise Time	BW Limiter selections	Other particularities
DC440	100 MHz	3.5 ns	35 MHz 2 pole Bessel	300 MHz Direct HF Input
DC438	100 MHz	3.5 ns	35 MHz 2 pole Bessel	
DC436	50 MHz	7.0 ns	NA	
DP310	100 MHz	3.5 ns	35 MHz 2 pole Bessel	300 MHz Direct HF Input
DP308	100 MHz	3.5 ns	35 MHz 2 pole Bessel	
DP306	50 MHz	7.0 ns	NA	

3.2.5. Input Voltage and Offset

The Standard Input provides a fully programmable amplifier with variable input voltage and offset. Full Scale (FS) input voltages are selectable from 250 mV to 10 V in a 1, 2, 5 sequence. Care should be taken

to select an input voltage range that will allow the signal to be recorded using as much dynamic range of the digitizer as possible. The Variable Offset is programmable in the range of ±1 V for FS ≤ 1 V, increasing to ± FS Voltage for less sensitive settings. The raw 12-bit ADC data values are read as 16-bit integers in the range [–32768, +32752] with steps of 16 LSB's between allowed values. The first and last values are reserved for underflow and overflow respectively. The midpoint value, 0, of the range corresponds to the negative of the offset voltage. Thus the Full Scale Range (FSR) goes from

–Offset Voltage **– (FS/2)** to –Offset Voltage **+ (FS/2)**

Signals going outside of the FSR will be clipped and data values for the clipped portion of a signal should be regarded as erroneous.

3.2.6. Vertical Resolution

The digitizers described in this manual use an ADC system with 12 bits of vertical resolution (4096 levels). The dynamic range of the ADC covers the Full Scale Range (FSR) of the Input Voltage setting. For example, if the FS Input Voltage is set to 1 V then the ADC resolution is equivalent to 0.2441 mV. However, the corresponding LSB gain is 1/16 of this value. To obtain the best dynamic range from the ADC care should be taken to ensure that the input signal varies over more than 50% of the Input Voltage FSR setting.

In the case of DC440, DC438, DP310, and DP308, for sampling rates, SR < 110.25 MS/s, the two ADC's of each channel can be used to sample the signal simultaneously and their results will be averaged. This gives 13 bits of vertical resolution, which means that for FS = 1 V the smallest difference between 2 data samples will be 0.122 mV.

3.2.7. DC Accuracy and Linearity

All of the 12-bit digitizers use low noise front-end electronics in order to ensure voltage measurement is made with accuracy and precision. DC voltage accuracy, at 0 V offset, is better than ±0.5 of the input voltage full scale. The differential linearity is better than ±0.5 LSB.

3.3. Data Acquisition

The table below summarizes the characteristics discussed in the sections that follow:

Model	Max. Sampling Rate	Max. Converters / channel	Default Memory points/ channel	Default Maximum Segments	Maximum Optional Memory/ channel	Maximum Segments	SR Adjustment Granularity	Minimum Deadtime
DC440	420 MS/s	2	64K	100	4M	8000	< 0.25 %	1 µs
DC438	200 MS/s	2	64K	100	4M	8000	< 10 %	1 µs
DC436	100 MS/s	1	64K	100	4M	8000	< 50 %	2 µs
DP310	420 MS/s	2	64K	100	4M	8000	< 0.25 %	1 µs
DP308	200 MS/s	2	32K	100	4M	8000	< 10 %	1 µs
DP306	100 MS/s	1	32K	100	4M	8000	< 50 %	2 µs

Some of these products are now offered with the Maximum Optional Memory as standard.

3.3.1. High Resolution Sample Rate

The high-end Acqiris 12-bit digitizers (DC440 and DP310) contain an analog-to-digital conversion (ADC) system that can sample waveforms, in a real time sampling mode, at rates from 420 MS/s down to

100 S/s (10 ms per point). The sampling rate can be programmed and is adjustable with a very fine granularity as partially shown in the table below:

Sampling Rate (MS/s)	SR resolution (kS/s)
200-420	500
100-200	250
50-100	125
25-50	62.5
20-25	31.25

Sampling Rate (MS/s)	SR resolution (kS/s)
10-20	25.0
5-10	12.5
2.5-5	6.25
2-2.5	3.125

Sampling Rate (MS/s)	SR resolution (kS/s)
1-2	2.5
0.5-1	1.25
0.25-0.5	0.625
0.2-0.25	0.3125

There are 1360 allowed values for each decade. The same pattern continues as one goes to the right beyond the table above. The last entry would be for SR = 100-200 S/s and a resolution of 250 mS/s.

For the DC438 and DP308 the sampling rate resolution is given by:

Sampling Rate (MS/s)	SR resolution (kS/s)
100-200	10000
50-100	5000
25-50	2500
20-25	1250

Sampling Rate (MS/s)	SR resolution (kS/s)
10-20	1000
5-10	500
2.5-5	250
2-2.5	125

Sampling Rate (MS/s)	SR resolution (kS/s)
1-2	100
0.5-1	50
0.25-0.5	25
0.2-0.25	12.5

There are 34 allowed values for each decade. The same pattern continues as one goes to the right beyond the table above. The last entry would be for SR = 100-200 S/s and a resolution of 10 S/s.

For the DC436 and DP306 the sampling rates available are:

Sampling Rate (MS/s)
100
75
50
37.5
25
20
15

Sampling Rate (MS/s)
10
7.5
5
3.75
2.5
2.0
1.5

Sampling Rate (MS/s)
1
0.75
0.5
0.375
0.25
0.2
0.15

Sampling Rate (kS/s)
100
75
50
37.5
25
20
15

The same pattern continues down to 100 S/s.

3.3.2. Acquisition Memory

Data from the ADC is stored in on-board acquisition memory. The amount of memory in use for acquisition can be programmed and is selectable from 1 point to the full amount of acquisition memory available.

For technical reasons, a certain memory "overhead" (approximately 200 points) is required for each waveform, reducing the available memory by a small amount. In order to simplify programming, Acqiris provides an interface function, which recommends the best sampling rate and the maximum possible

number of data points, taking into account the available memory, the requested time window, the number of segments (in Sequence mode), as well as the required memory overhead.

To ensure maximum sampling rate and high timing resolution, Acqiris strongly recommends the use of long acquisition memories whenever possible. For example, the DC440 with 4 Mpoints of memory can record a signal over a 10 ms period with a sampling rate of 400 MS/s (2.5 ns per point). The fast sampling rate ensures that all high frequency signal components, up to the full 100 MHz bandwidth of the digitizer, are accurately recorded. If the memory were reduced to just 20 Kpoints then the sampling rate would need to be reduced to just 2 MS/s (20,000/10 ms) to record the same 10 ms period. All frequencies above 1 MHz would then be incorrectly digitized and important signal characteristics may be distorted or even completely missed.

3.3.3. Single and Sequence Acquisition Modes

Digitizers acquire waveforms in association with triggers. Each waveform is made of a series of measured voltage values (sample points) that are made by the ADC at a uniform clock rate. To maximize sampling rates and utilize memory as efficiently as possible, the digitizers include both Single and Sequential storage modes.

The Single Acquisition mode is the normal operation of most digitizer products. In this mode an acquisition consists of a waveform recorded with a single trigger. The user selects the sampling rate and acquisition memory size and set the number of segments to 1 (default value).

The Sequence Acquisition mode allows the capture and storage of consecutive “single” waveforms. Sequence Acquisition mode is useful as it can optimize the digitizer’s sampling rate and memory requirements for applications where only portions of the signal being analyzed are important. The mode is extremely useful in almost all impulse-response type applications (RADAR, SONAR, LIDAR, Time-of-Flight, Ultrasonics, Medical and Biomedical Research, etc.).

In Sequence Acquisition mode the acquisition memory is divided into a pre-selected number of segments. Waveforms are stored in successive memory segments as they arrive. Each waveform requires its own individual trigger. The memory can be divided into any number of segments between 2 and 100 (up to 8000 segments with options M4M). In Sequence Acquisition mode the user needs to specify the sampling rate, the total acquisition memory and number of segments. Note that the Single Acquisition mode is just a special case of the Sequence Acquisition mode with the number of segments set to 1.

Sequence acquisition enables successive events, which can occur within a very short time, to be captured and stored without loss. A crucial feature of Sequence Acquisition mode is that it has a very fast trigger rearm time. A fast trigger rearm helps produce very low “dead time” between the segments of a sequence acquisition. The “dead time” is the period after the end of an event when the card cannot digitize data for a new trigger event. To complement this mode of operation the digitizer can also measure and store the arrival time of each trigger using the information from the on board TTI (Trigger Time Interpolator). Readout of the individual trigger time stamps makes it possible to determine the time from one trigger to any other trigger in the sequential acquisition. The TTI resolution sets the resolution of the trigger time stamps (see section 3.3.4 **Timing**).

3.3.4. Timing

A crystal-controlled timebase is used to clock the ADC system of the digitizers. The timebase accuracy is guaranteed to be better than ± 2 ppm. The digitizers also include a built-in Trigger Time Interpolator (TTI) that measures the time from the trigger point to the first sample point. This information is essential for determining the relation between the trigger or other event of interest and the digitized samples of the signal. The TTI resolution is 5 ps for a sampling interval of 2.5 ns (SR = 400 MS/s). As the SR decreases the TTI resolution is kept at 0.2% of the sampling interval. However, there is a jitter of up to ±60 ps in the positioning of the data with respect to the trigger point.

3.3.5. Timebase Range

The timebase range defines the time period over which data is being acquired. For example, the DC440 has a standard acquisition memory of 64 Kpoints and maximum warranted sampling rate of 400 MS/s.

Therefore, at this sampling rate, the digitizer can record a signal over a timebase range of up to 160 µs (approx. 64,000 points * 2.5 ns/point). The timebase range can be adjusted by varying the amount of acquisition memory or the sampling rate of the digitizer.

3.3.6. Sparkle code rate

The high-end Acqiris 12-bit digitizers (DC440 and DP310) contain an analog-to-digital conversion (ADC) system that can sample waveforms at rates up to 420 MS/s. This makes them ideally suited to frequency domain observations. On the other hand, real time single shot waveforms are used in other applications and one of their important specifications is the sparkle code rate. This is the probability that a sampled data point differs from its true value by more than a specified deviation. For the purposes of this discussion we take the allowed deviation to be 3.1% FS (128 ADC counts). At lower sampling rates (<200 MS/s) all of the 12-bit digitizers show a low occurrence of sparkle codes. The sparkle code rate is 10^{-12} typical at 200 MS/s. However, at sampling rates above 200 MS/s the chances of a sparkle code occurring increase with the sampling rate. The sparkle code rate reaches 10^{-7} typical at 400 MS/s.

3.4. Trigger

The trigger settings applied to the digitizer are used to determine the time at which the device will stop acquiring data. The various trigger settings are outlined below.

3.4.1. Trigger Source

The trigger source can be a signal applied to either a Standard Input Channel (internal triggering) or the External Trigger Input. Signals on the HF inputs cannot be used.

The digitizers provide a front panel BNC External Trigger Input. The External Input provides a fully functional trigger circuit with selectable impedance (50 Ω or 1 MΩ), coupling, level and slope as for the Internal Triggering source. In addition, the External Trigger Input can be used to generate a TV trigger.

The circuitry provides an overload protection that will automatically switch the coupling from 50 Ω to 1 MΩ if the signal is greater than ±5 V DC. A ±5 V limit on trigger signals should be respected, although somewhat higher voltages for short time periods will not damage the unit. For 1 MΩ input signals up to ±100 V (DC + peak AC < 10 KHz) are allowed.

3.4.2. Trigger Coupling

Trigger coupling is used to select the coupling mode applied to the input of the trigger circuitry. Modes available include AC LF Reject and DC. The AC LF Reject mode couples signals capacitively and removes the input signal's DC component and signals below 50 KHz. DC mode allows all signal components to be passed through to the trigger circuit.

3.4.3. Trigger Level

The trigger level specifies the voltage at which the selected trigger source will produce a valid trigger. The trigger level is defined as a set voltage. Using the internal trigger, the level is set with respect to the midpoint voltage (V_m= – Offset voltage) of the digitizer's vertical scale. Internal trigger level settings must be within V_m ± 0.6 FS, where FS is the channel Full Scale. All trigger circuits have sensitivity levels that must be exceeded in order for reliable triggering to occur.

The AC coupled mode is implemented with an auto-level trigger.

The external trigger level can be set to values in the range ± 3 V. Input signals up to ±5 V DC can be input without damaging the circuitry. The external trigger 3 dB bandwidth is 400 MHz.

The digitizer will trigger on signals with a peak-peak amplitude > 10% FS from DC to their bandwidth limit.

3.4.4. Edge Trigger Slope

The trigger slope defines which one of the two possible transitions will be used to initiate the trigger when it passes through the specified trigger level. Positive slope indicates that the signal is transitioning from a lower voltage to a higher voltage. Negative slope indicates the signal is transitioning from a higher voltage to a lower voltage.

3.4.5. Pre- and Post-Trigger Delay

To increase trigger flexibility a pre- or post-trigger delay can be applied to the trigger position.

The amount of pre-trigger delay can be adjusted between 0 and 100% of the acquisition time window (i.e. sampling interval x number of samples), whereas the post-trigger delay can be adjusted between 0 and 100 million samples.

Pre- or post-trigger delays are just different aspects of the same trigger positioning parameter:

- The condition of 100% pre-trigger indicates that all data points are acquired prior to the trigger, i.e. the trigger point is at the **end** of the acquired waveform.
- The condition of 0% pre-trigger (which is identical to a post-trigger of 0) indicates that all data points are acquired immediately after the trigger, i.e. the trigger point is at the **beginning** of the acquired waveform.
- The condition of a non-zero post-trigger delay indicates that the data points are acquired after the trigger occurs, at a time that corresponds to the post-trigger delay, i.e. the trigger point is **before** the acquired waveform.

The digitizer hardware accepts pre- and post-trigger adjustments in increments of 16 samples. By definition post-trigger settings are a positive number and pre-trigger settings are a negative number.

Thus it is only natural that the software drivers provided by Acqiris treat pre- and post-trigger delays as a single parameter in seconds that can vary between *–nbrSamples * samplingInterval* (100% pre-trigger) and *+maxPostTrigSamples * samplingInterval* (max post-trigger). Since the Acqiris software drivers provide very accurate trigger position information upon waveform readout, the accepted resolution of the user-requested pre-/post-trigger delay is much better than 16 samples. For more details, refer to the Programmer's Guide**.**

3.4.6. TV Trigger

The TV trigger mode can be used for a composite video signal with negative/going synch (positive modulation) on the External Trigger Input. The TV trigger mode implements line number and odd/even field selection for 625/50/2:1 (PAL/SECAM, B/G/L Standards) and 525/60/2:1 (NTSC, M Standard) signals. The TV trigger is AC coupled and a minimum synch pulse amplitude of 0.3 V pk-pk is required.

3.4.7. Trigger Status

The front panel includes a tri-color LED indicator to show the status of the trigger. When the LED is green it indicates the trigger is armed and waiting for a valid trigger to occur. Red indicates that the trigger has occurred, the acquisition is complete and the data is waiting to be readout. The user can override the default functions and program the LED color in an application-specific manner.

3.5. External Clock and Reference

For applications where the user wants to replace the internal clock of the digitizer and drive the ADC with an external source, either an External Clock or an External Reference signal can be used. The Clock or Reference signals can be entered into the digitizer by the dedicated MMCX.

When using a continuous External Clock, the user must ensure that the input signal has a frequency between 100 MHz and 400 MHz. If the Start/Stop External Clock mode is used the maximum clock frequency is 210 MHz and the data will have 13-bit resolution. The input signal must have a minimum

amplitude of at least 1 V peak to peak into 50 Ω at the front of the digitizer. The transitions of the clock are defined with the aid of a threshold that is user selectable in the range [-2.0 V, 2.0 V]. The signals should not exceed ±5 V amplitude. For a detailed discussion on the programmed use of the external clock, refer to the Programmer's Guide.

For applications that require greater timing precision and long-term stability than is obtainable from the internal clock, a 10 MHz Reference signal can be used. The External Reference is nominally at 10 MHz. However, frequencies in the range [9.0 MHz, 11.0 MHz] will be accepted. If you do this you may need to correct for the difference in your application since the digitizer and the driver have no way to know about such deviations. The amplitude and threshold conditions, for an External Reference, are the same as for the External Clock. If synchronization between several digitizers is required, the reference signal should be applied to all of them.

3.6. Internal Calibration

The software drivers supplied by Acqiris include calibration functions for the timing, gain and offset settings, which can be executed upon user request. The digitizers are never calibrated in an "automatic" way, i.e. as a side effect of another operation. This ensures programmers have full control of all calibrations performed through software in order to maintain proper event synchronization within automated test applications.

The digitizer includes a high precision voltage source and a 16-bit DAC, used to determine the input voltage and offset calibration.

For accurate time and voltage measurements it is recommended to perform a calibration once the module has attained a stable operating temperature (usually reached with a few minutes after power on). It should also be already set to the desired timebase settings. Further calibration should not be necessary unless temperature variations occur.

3.7. ASBus

The digitizers may be used in applications that require many data acquisition channels. In such cases it is possible to use more than one digitizer in a standard CompactPCI/PXI crate. Each DC Series digitizer includes ASBus, a proprietary high bandwidth auto-synchronous bus system that allows multiple digitizers to work together synchronously.

The ASBus distributes both the clock and trigger signals along a plug-in front panel bus, between all the digitizers that participate in the system. It allows any digitizer to act as the trigger source and any other digitizer to act as the clock source (acquisition master), enabling all the digitizers to be clocked at the same time. Synchronizing the clock signals between the devices improves the accuracy of cross-channel measurements and is essential for accurate time correlation between signals on different channels.

The ASBus is intended to connect modules of the ***same type***, i.e. of the same model number, although some exceptions to this rule might be possible. If modules with the same model number, but different memory length options, are connected only the shortest memory length can be used.

The ASBus connector is located on the front panel of each module. Bridges are used to connect adjacent modules for synchronization, which is then activated through software by defining a master module and the trigger source. Up to 7 modules may be synchronized with the ASBus. More detailed information and the commands required to set up the ASBus clock and trigger distribution are included in the Programmer's Guide and Reference manual.

3.8. Special Front Panel Inputs and Controls

Connector	Function
MMCX CLK IN	External Reference or External Clock.
MMCX I/O A	User configurable (see below)
MMCX TR OUT	Signal occurs after an accepted TRIGGER.
MMCX I/O B	User configurable (see below)

The I/O A and I/O B signals are 3.3 V compatible CMOS. This means that, on input, low is < 0.7 V and high must be in the range [1.7 V, 5.0 V]. An unconnected signal will be high. This definition ensures TTL compatibility. On output, the low level will be in the range [0 V, 0.7 V] and the high level in the range [1.7 V, 3.3 V] for HiZ. The high level output will typically give 0.8 V into 50 Ω. The I/O A or B connectors can be used for an *Enable trigger input*

or the following output signals:

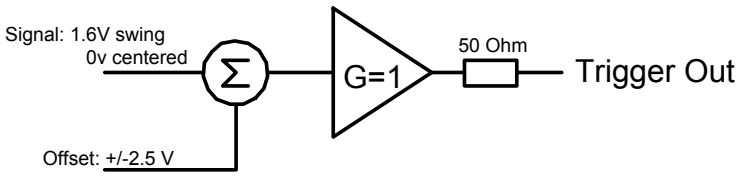
- *10 MHz reference clock. To ensure good rise time characteristics the output impedance is 50 Ω (in the case of the DC units this is only available on I/O B)*
- *Acquisition skipping to next segment,*
- *Acquisition is active,*
- *Trigger is armed.*

3.9. External Trigger Output

When the digitizer is ready to be triggered and a valid trigger signal occurs, a trigger output is generated for external use. It is always available on the Front Panel Trigger Out MMCX connector.

⚠ ***NOTE:*** *The External Trigger Output functionality is implemented in the hardware. No Trigger Out signal occurs for software-generated triggers such as those of the AUTO mode of AcqirisLive or through the use of the function* ***AcqrsD1_forceTrigger***. However, ***AcqrsD1_forceTriggerEx*** does generate the signal.

Trigger Output Block diagram:

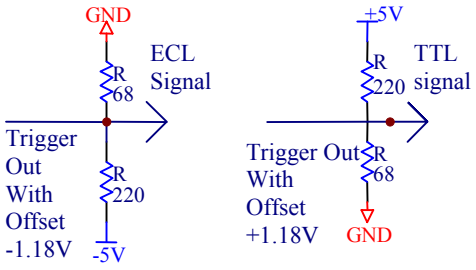


The output swing is 1.6 V (± 0.8 V) when unloaded and 0.8 V when terminated on 50 Ω. The rise and fall times are 2.5 ns typical. The offset can be adjusted, by software control in the range [–2.5 V, +2.5 V] unloaded, or [-1.25 V, +1.25 V] into 50 Ω. The maximum output current capability is ± 15 mA. As the output is retro-terminated, it is possible to drive a 50 Ω line unterminated (HiZ) without loss of performance.

For a TTL compatible signal, set the offset to 1.0 V and the swing at destination will be +0.2 to +1.8 V.

For an ECL compatible signal, terminated on 50 Ω to –1.2 V, set the offset to –1.2 V and the output will be in the range [–0.8 V, –1.6 V]).

Alternatively, to reduce the current drawn from the digitizer, the terminations shown here can be used:



3.10. Electrical, Environmental and Physical Specifications

3.10.1. Electrical

	Max. Power Consumption (W)		Current Requirements (A) (with Memory option)			
Model	**Standard**	**with Memory option**	**+12 V**	**+5 V**	**+3.3 V**	**-12 V**
DC440	23	25	0.6	1.5	1.6 (2.2)	0.2
DC438	23	25	0.6	1.5	1.6 (2.2)	0.2
DC436	21	23	0.6	1.5	1.6 (2.2)	0.2
DP310	15	17	0.5	0.8	1.0 (1.5)	0.1
DP308	15	17	0.5	0.8	1.0 (1.5)	0.1
DP306	13	15	0.5	0.4	1.0 (1.5)	0.1

All modules conform to Revision 2.2 of the PCI Local Bus Specification. They all use the PCI Bus at 33 MHz.

3.10.2. Environmental and Physical

The modules have a Declaration of Conformity according to ISO/IEC Guide 22 and EN45014 and **CE** Marks of Compliance.

The American Standard MIL-PRF-28800F has been used as the source for many of the characteristics specified below. Those indicated with a '*' are compatible with Class 3 as defined in that standard.

The front panels of the CompactPCI modules are in compliance with the IEEE 1101.10 standard.

Operating Temperature

0° to 40°C

The above values are for the ambient temperature of the room (or equivalent) where the CompactPCI crate is located. The temperature as measured on the board may well be significantly higher. On-board temperatures above 60°C should be avoided.

Relative Humidity*

5 to 95% (non-condensing)

Dimensions

DC modules conform to the 6U CompactPCI standard (233 mm × 160 mm × 20 mm). DP modules (107 mm × 210 mm) require a long card slot. If used with the XP103 fan they can be adjusted to conform to the full 342 mm length. All other cards require a short card slot (107 mm × 175 mm). An XP100 fan will add 45 mm to the length of any card..

Shock*

30 G, half-sine pulse

Vibration*

5-500 Hz, random

Safety

Complies with EN61010-1

EMC Immunity

Complies with EN61326-1: Industrial Environment

EMC Emissions

Complies with EN61326-1: Class A for radiated emissions

Required Airflow

> 2 m/s in situ

4. Running the AcqirisLive Application

4.1. Getting Started with AcqirisLive

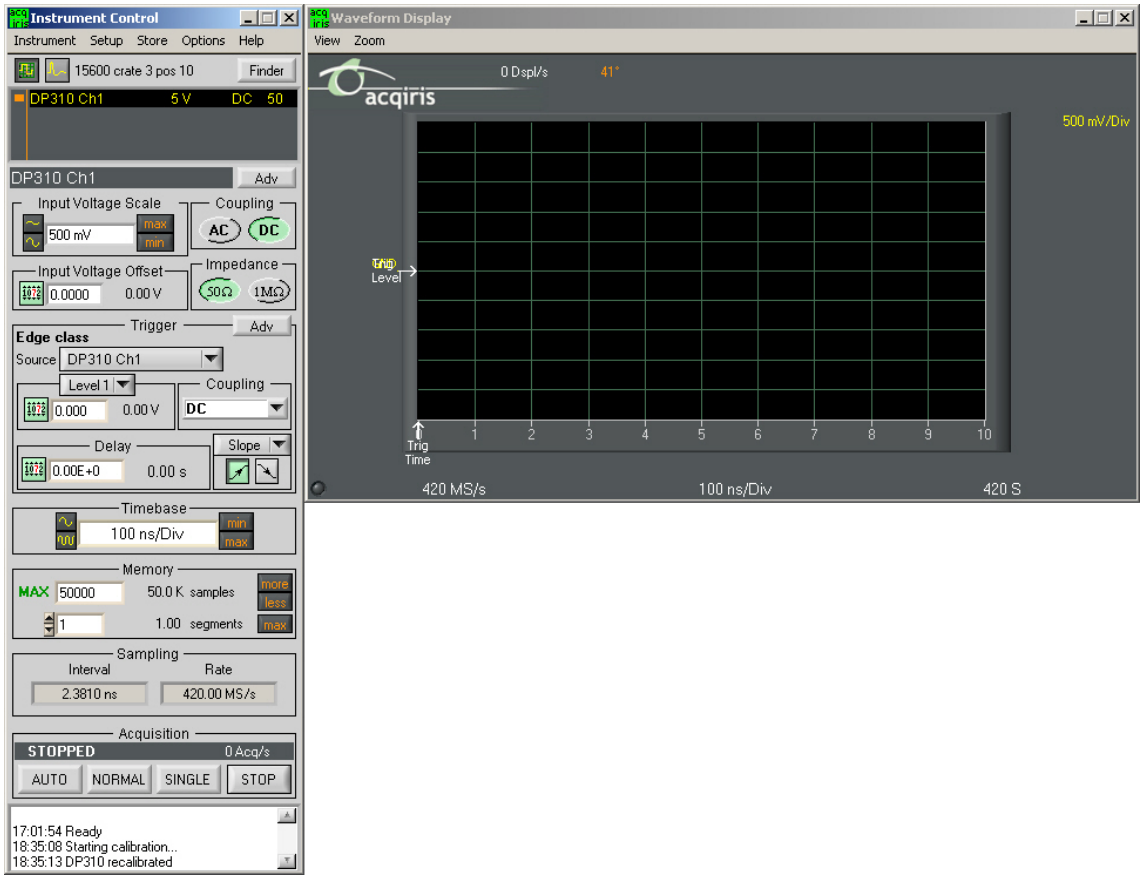
Once the software and hardware installation described in Section 2 of this manual is complete, you will find AcqirisLive in the start menu of your computer. Start AcqirisLive from the menu. An initial AcqirisLive load screen will appear followed by a panel of controls and a waveform display window.

During startup, AcqirisLive searches for all Acqiris Digitizers on the PCI bus. If no digitizers are found on the PCI bus, AcqirisLive will display an error message indicating that no digitizers were found, and the program will continue in simulation mode. If this is not wanted, turn off the computer, install and turn ON the hardware on the PCI bus and, then, restart the computer.

AcqirisLive is intended to verify the functionality of the card and to serve as an easy to use and convenient program for capturing, displaying, and archiving captured data into the format of your choice, binary or ASCII. AcqirisLive is provided free with the purchase of any Acqiris Digitizer.

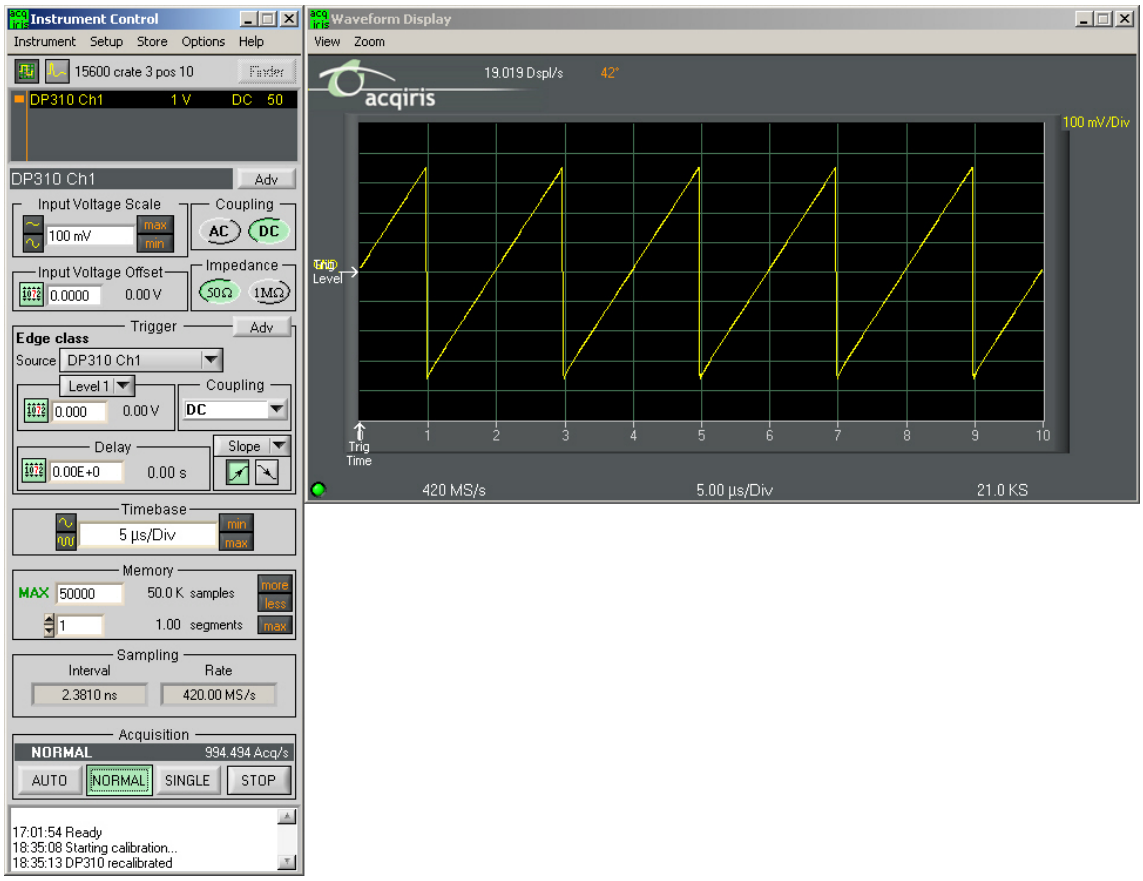
Acqiris supplies drivers on the CDROM for National Instruments LabWindows/CVI, LabVIEW, Microsoft Visual C++, and Visual Basic. Acqiris also provides some examples (GetStarted applications) as a guide or starting point for programmers developing their own applications to interface with the DC or DP series digitizer cards.

When you start AcqirisLive a display like that shown below appears.



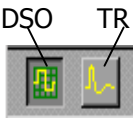
AcqirisLive displays two independent windows, a control window and a display window. The control window contains functions that allow you to manipulate the acquisition parameters of the card. In order to display an acquired waveform, connect a signal to the input, and then select the Auto acquisition mode at the bottom of the control panel. A waveform should appear in the display.

Other controls in the control panel allow you to select the optimal acquisition settings for your particular signal. Each of the other control panel functions will be discussed in detail in the following Control Panel Functions section. Here is a sample result.



4.2. Control Panel and Functions

4.2.1. Control Panel Mode



In AcqirisLive there are two control panel modes available, Oscilloscope Mode and Transient Recorder mode. The choice of mode is entirely determined by the preference of the user.

Both modes provide the same set of functional capabilities but display the settings slightly differently. For example in Transient Recorder mode, the user selects the Full Scale Range of the amplifier whereas in Oscilloscope Mode the user selects the input voltage scale set in Volts/Div. The desired mode is selected using one of the two buttons shown at the top of the control panel. The distinction between the control panels for the two operating modes can be seen in the images below.

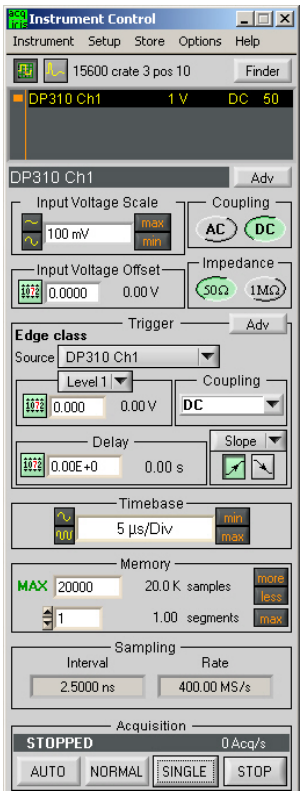
In both modes it is possible to set the memory depth and the sample speed independently within the limits of the maximum available memory. However the two modes differ in the following way.

In Oscilloscope Mode, the user selects the time window (time per div) and the sampling rate will be adjusted to the fastest possible within the limits of the available memory. The maximum available memory is programmable.

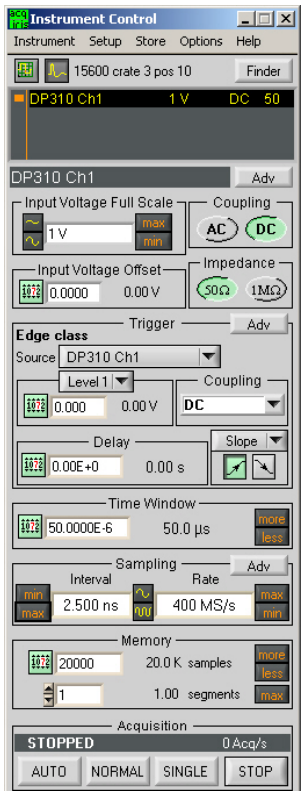
In Transient recorder mode, the user selects the capture time window, the sampling rate, or the number of samples. When selecting the capture time window, the number of samples is adapted, keeping the current sampling rate and number of segments, up to the maximum available memory on the card. When selecting the sampling rate, the number of samples is adapted, keeping the current capture time window

and number of segments, up to the maximum available memory on the card. When selecting the number of samples, the capture time window is adapted, keeping the current sampling rate and number of segments.

Oscilloscope Mode



Transient Recorder Mode



4.2.2. Displaying Multiple Traces

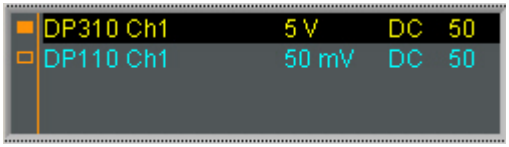
If multi-channel modules, or several single channel modules, are installed on the PCI bus, multiple waveform displays, one from each installed channel, are overlaid on the display.

The **current channel** is selected by clicking on the channel name within the upper portion of the control panel. The vertical settings of the current channel and the timebase and trigger of the correspondent digitizer are then indicated. A unique name is given to each channel installed on the PCI bus. The current channel is indicated by a dark highlight over the name. Settings changed on the main control panel will only affect the active channel. Always verify proper acquisition setting for each channel prior to collecting data.

There is a small rectangular indicator button to the left of each channel name in the channel list. If this indicator is black, the channel waveform is active; the channel is turned on and displayed in the display window. Clicking on this indicator once turns it transparent. This deactivates the reading of the data from the channel and clears the waveform display. Clicking once again on the indicator turns the channel back on and the indicator black. After making such changes the channel data will not be displayed until after the next acquisition.

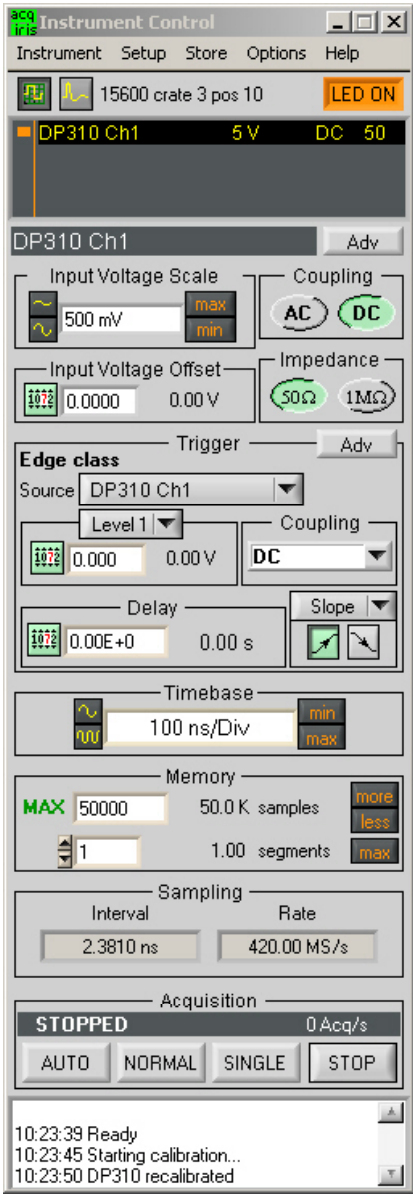
The image at the left shows a channel list with two active channels in the system. All are turned on and displayed in the display window as indicated by the orange indicators at the left. The DP310 Ch1 is the currently selected channel.

The channel list image at the right shows the same system. The DP110 Ch1 indicator is transparent and therefore this channel is turned off and not displayed.



As an alternative to controlling the channels to be displayed from the control panel you can also control them by selecting the desired channels from the list of channel gains shown at the right hand side of the display window.

Pressing the Finder button at the top of the control panel will identify the module associated with the current channel. When the finder button is depressed, the LED on the front panel lights up yellow on the digitizer module with the current channel.



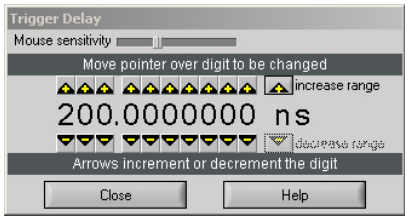
4.2.3. Numeric Editor

The numeric editor is shown in the control window at locations where numeric values are set. The Acqiris Numeric Editor enables easy input of numeric values, particularly those ranging over many decades. The numeric value can be changed in multiple ways.

A number can be typed directly into the white number display area or alternatively, the Acqiris Numeric Editor may be used. In order to use the Acqiris Numeric Editor, click on the green numeric editor icon at the left of the number display. A numeric editor control will appear as shown.

The methods to change the values are:

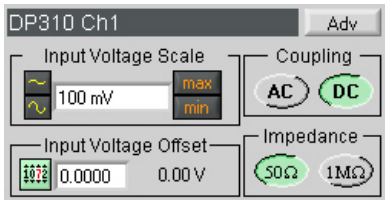
1. Increment or decrement any digit with the arrow buttons by pressing the increment or decrement button. When the button is held down, the digit will continue to increment or decrement automatically.
2. Click on a digit and drag the mouse up or down to increase or decrease the value.
3. Type a new value with the keyboard for any highlighted digit.



The value is constrained to fall within its allowed range whenever the user attempts to enter a larger or smaller value. Digits that are below the resolution or granularity cannot be modified. A message is displayed in the numeric setting control window when the pointer is positioned over a digit that is below the allowed granularity and cannot be changed.

4.2.4. Input Voltage Scale, Offset and Coupling

Settings for input voltage scale, offset, coupling and impedance are available in the portion of the control panel shown to the right. The selected channel is shown on the upper section of the display. Only this channel will be affected by changes in any settings on the control panel. The input voltage scale is set by one of three possible methods:



1. Clicking on the white numeric display of the voltage scale will show a pop-up list. Select the desired gain setting with the mouse pointer.
2. Clicking on the Decrement / Increment icons will step the voltage scale up or down to the next level for each click of the mouse.
3. Clicking Max / Min will toggle to the least sensitive gain setting or to the most sensitive gain setting.

⚠ ***NOTE*** *Coupling* is used to select which signal input connector is to be used.

The input *Coupling* can be set for AC or DC. The selected setting is shown as an actuated indicator with a green backlight. For the DC440 and the DP310, the AC coupling setting is used to choose the Direct HF Input SMA Connector. In DC coupling the Standard Input BNC is in use and all frequency components are passed through the input.

The *input voltage offset* control applies an offset to the input amplifier in order to better digitize and display signals offset away from 0 volts. Signals riding on a DC level can be most accurately characterized when the offset is adjusted so that the acquisitions are made about the midpoint of the digitizer's Full Scale Range, and when as much of the 12-bit ADC range is used as possible. The ability to select an offset voltage enables accurate measurement when offsets are present in the signal.

The *Impedance* selection is not active for 12-bit digitizers since only 50 Ω is allowed.

The *Adv* button in this section gives access to the choice of hardware bandwidth limits for the channel.

4.2.5. Keyboard shortcuts

Two shortcuts have been defined to simplify applying changes of a parameter to a group of channels. When the mouse is over the control of a channel parameter -

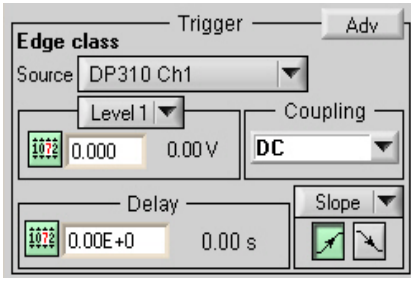
- 's' can be used to set the current value to all channels of all available instruments
- 'c' can be used to set the current value to all channels of the current instrument.

Other shortcuts are:

- 'Ctrl-S' as a synonym for 'Save Setup'
- 'Ctrl-R' as a synonym for 'Recall Setup'
- 'Ctrl-C' as a synonym for Calibrate all (active) instruments'
- 'Ctrl-E' functions as a toggle between 'Internal Clock' and 'External Clock' operation.

4.2.6. Trigger

Trigger characteristics are set using the settings in the control panel *Trigger* section. The trigger *source* setting can be either Internal (trigger on any one of the input channels) or External (trigger on an external input). The trigger source is indicated in the display by the name appearing under *Source*.



In order to select the trigger source, click the drop-down source menu in the trigger *Source* section of the control panel and choose the desired one.

Notice that, when external trigger is selected, the controls for the trigger termination, 50 Ω or 1 MΩ, are enabled in the *Coupling* section. Select the desired termination for the external trigger.

The *Coupling* section also contains a selection for AC or DC coupling. AC coupling on the trigger sets the trigger circuit to an AC Low Frequency Reject mode.

Use the *Level* section to set the desired trigger level. The relationship between coupling, trigger source, and trigger level was discussed in section 3.4.3 **Trigger Level**.

The trigger *Delay* setting positions the acquisition with respect to the trigger. Pre-trigger values are negative and are selectable in the range of [0 to – (10 * timebase)]. The value (10 * timebase) is equivalent to the time window or *capture-time*. 100% pre-trigger is achieved by setting

Delay = – (*capture-time*).

A 100% pre-trigger delay means the trigger point is at the right edge of the display and all of the data in the acquired waveform were captured just prior to the trigger event.

Maximum Post trigger delay settings depend on the sample interval used. Post trigger delays are adjustable up to 100 Mpoints.

When a *Slope* box is shown next to the delay section, selecting the trigger slope is achieved by depressing either the positive or negative slope buttons.

4.2.7. Acquisition Mode

The acquisition mode of the digitizers is selected using one of four acquisition mode buttons in the Acquisition section of the control panel. Available acquisition modes are Auto, Normal, Single and Stop.

This Acquisition section of the control panel also indicates the number of waveforms acquired per second by the digitizer. The use of each of the acquisition modes is described below. In the discussion, a valid trigger indicates a trigger signal meeting the trigger conditions at a time when the digitizer is armed and ready to acquire data.

Stop will stop the acquisition and hold the latest complete acquisition on the display.

Single mode is used in order to capture one event at the first valid trigger. It freezes the acquisition in the digitizer's memory, and on the display, until the user requests another acquisition. After an acquisition is taken in Single mode, the digitizer will ignore subsequent trigger events until the Single button is pressed again or another acquisition mode is selected. Pressing the single button re-arms the trigger and captures one acquisition at the next valid trigger.

Normal mode is used to continuously acquire waveforms into memory for valid trigger events. The display is updated with the new acquisitions in accordance with the Display Refresh Rate setting under the Options menu on the top line of the AcqirisLive Control window. Acquisitions will happen for each valid trigger until either single or Stop is pressed.

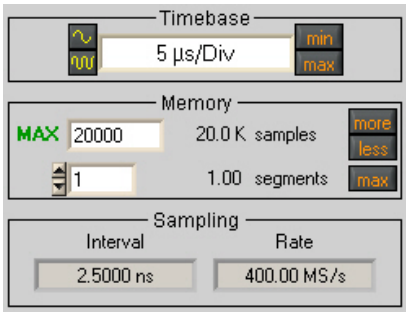
If the trigger indicator at the lower left of the waveform display does not blink green, the digitizer is not receiving valid triggers. Check the trigger settings or select Auto mode in order to obtain a display of the waveform.

Auto mode will acquire and display waveforms according to the trigger settings if a valid trigger is present within a timeout interval. If a valid trigger is not available within this interval, the digitizer generates its own trigger in order to digitize and display whatever signal is at the input at that time.

If valid triggers are received at a high enough rate, Auto mode behavior differs little from normal mode behavior on the display. However if the trigger rate is too low or trigger settings are not appropriate for the characteristics of the signal, the input signal will not be stable on the display. This occurs because the internal auto-trigger generated by the digitizer is asynchronous to the input signal.

Auto mode is often used to aid in setup when the input signal must be quickly characterized in order to determine proper trigger settings for Normal or Single mode acquisitions.

4.2.8. Timebase and Memory



The timebase and memory settings should be chosen together in order to optimize the desired sample rate for the acquisition.

In oscilloscope mode the timebase settings range from 1 ns/div to 5 S/div. In transient recorder mode time windows of 0.5 ns to 40 Ks are available when using a card with the 4 Mpoint memory option.

In order to change the timebase click on the white area in the timebase display window and select the desired timebase from the list. Alternatively, the Decrement / Increment timebase selection buttons may be used in order to change the timebase in steps with each click of the mouse. The sample rate and sample interval resulting from the combination of memory and timebase are indicated under the *Sampling* section of the control panel.

The Memory setting shows the maximum number of points to be acquired. The actual number of points acquired could be less than the maximum number set if the acquisition time window selected fills less than the selected amount of memory at the full sample rate. Alternatively, in oscilloscope mode, if a slower timebase is selected, in order to ensure that the selected amount of memory will be filled before the acquisition is complete, the digitizer will reduce its sample rate as necessary. This action differs from the same case in transient recorder mode where preference is given to the selected sample interval.

In transient recorder mode, the digitizer will continue to allocate more memory with increasing capture times. This is done in order to maintain the selected sample interval for as long a time window as is possible given the available memory. When the card memory is fully utilized, the sample rate will decrease with increasing capture times. In this mode many sampling rate or interval choices are possible. Moreover, if the *Adv* Sampling option is activated the full range of potential choices becomes available.

4.2.9. Using digitizers of different models simultaneously

AcqirisLive features a single *timebase* (i.e. the set of acquisition parameters pertaining to the time axis of the waveform, such as the sampling rate and the number of samples). It is therefore not possible to specify different timebase settings for different digitizers. However, it is possible to run each digitizer at its maximum available sampling rate performance in the following way:

- Select the *Scope mode*.
- In the channels list, select a channel from the fastest digitizer (that will make that digitizer the *current digitizer*).
- Make sure the maximum number of samples (*MAX samples* in *Memory* panel) is large enough.
- Select the desired time per division setting (*timebase* panel): the fastest sampling rate for the current digitizer, compatible with the maximum number of samples, will be selected and applied to all digitizers in the system. Any digitizer not capable to satisfy that sampling rate will run at its closest setting.

Finally, note that the sampling rate menu (visible in *Digitizer mode*) contains the sampling rate capability of all digitizers currently in use. You must turn off the channels of 'slower' digitizers in order to view the highest sampling rates of the 'faster' digitizers.

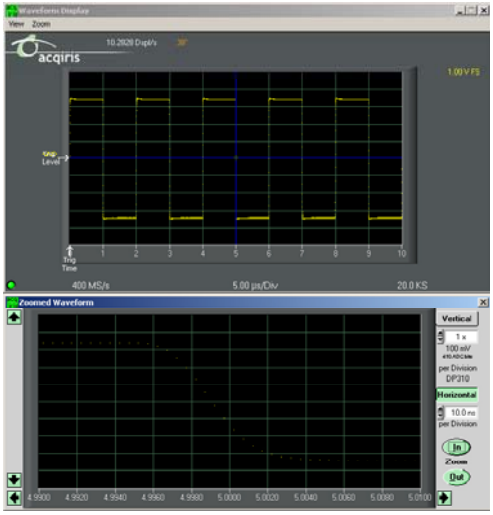
4.2.10. Segmented Memory

Segmented memory enables the sequential acquisition mode having less than 1 µs dead time between segments at the maximum sampling rate. This feature is particularly useful when capturing impulse-response type waveforms in a variety of applications. Segmented memory is available in all acquisition modes. However, it is generally used in either Normal or Single mode. Waveform display occurs only

after all segments are filled. Segments can be displayed sequentially on the display or they can be overlaid on top of each other. To select an overlaid display, select the item Overlay Segments under the Options menu. Segmented data can be archived to any storage device on the computer in a similar way to non-segmented acquisitions. If the acquisition needs to be stopped before all segments are filled, press the Stop button.

In order to set up the sequential acquisition mode, simply select more than 1 segment on the segment selection control under the *Memory* section of the control window and start the acquisition.

4.2.11. Display Features, Zoom and Persistence



A waveform zoom feature is available under the View menu of the display window. The screen image below shows the normal display and the zoom window that appears when zoom is selected.

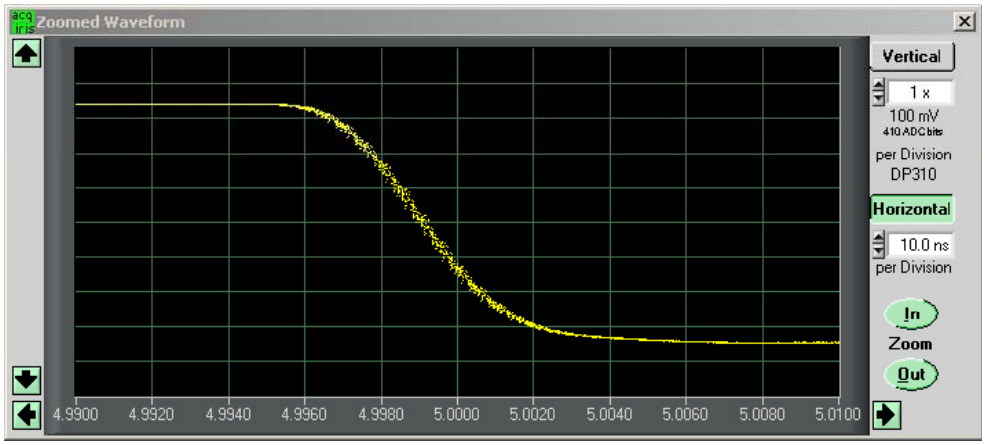
The zoom scale and center position are modified using the horizontal and vertical controls shown on the zoom display window. To the right side of the zoom window click on the "Horizontal" button, then modify the zoom expansion factor by clicking the "In" or "Out" buttons.

The vertical blue cursor, or box, (depending on the zoom factor), shown on the main display window indicates the center point and range of the zoom. The vertical box or line can be dragged right or left with the mouse in order to re-position the center point of the waveform displayed in the zoom display window. Alternatively, the right and left arrows at the bottom of the zoom display window will reposition the horizontal center of the zoom.

In order to expand the zoom region vertically, select the "Vertical" button on the zoom display and click the "In" / "Out" buttons. Alternatively, the up / down arrows on the scale indicator just below the vertical button can be used. When the vertical scale is expanded, the top and bottom lines forming the blue box in the main display window show the extent of the vertical zoom region. The vertical position of the box, and thus the data region shown on the zoom display, may be changed by moving the box vertically with the mouse or by clicking on the up and down arrows at the left of the zoom display window.

When expanding a waveform to the point where individual data points are seen, it may be desirable to use the "Connect data points" option under the Options menu in AcqirisLive. When this option is selected, larger data points are drawn on the display and a line connects each point.

The main display window contains a drop down selector that controls the display type for both the main display and the zoom window. There are two modes available, the Live Display, or the Persistence Display. When persistence display is selected, all points drawn to the display windows remain on while new points are added from subsequent acquisitions. This mode is particularly suited for examining the jitter on an edge of a periodic signal as shown in the image below.



To clear the display in persistence display mode, press the "Clear" button that appears on the main display window.

4.3. Top Line Menu of AcqirisLive

The top line menu contains functions offering additional utility to the AcqirisLive application. Provisions are included for storing instrument setups, waveforms, converting the format of stored data files, identifying models and versions and in the Options Menu, calibrating the digitizer, extended control of event acquisition and controlling the display properties. These possibilities are discussed in the next few sections.

4.4. Setup

The Setup menu allows you to store and recover instrument configurations. When you store a configuration the parameters used to configure each of the channels of each module together with the timebase and trigger configurations will be saved in a file. You will be asked to choose the destination directory for the file and be allowed to give it an appropriate name. When you choose to recover a file you will be asked to give the name or navigate to it using the browser functionality. If you are using many modules the settings in the configuration file will be associated preferentially with the digitizer that has that serial number or then with the digitizer in the same location.

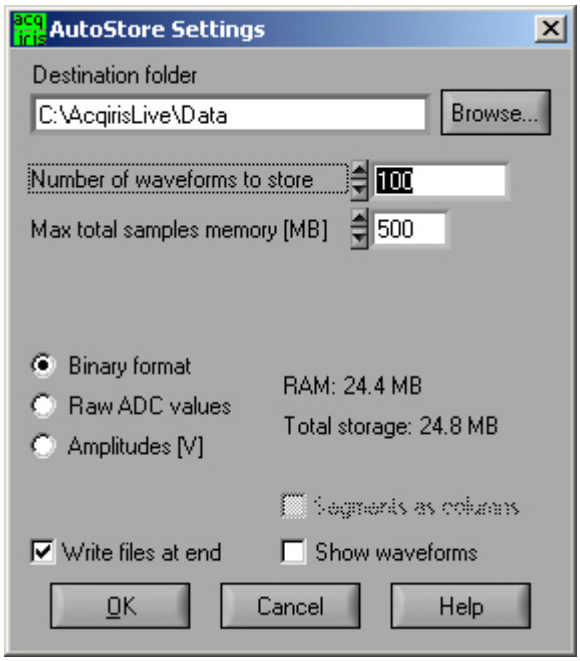
Only the parameters of the modules are stored in the configuration file. This means that parameters of the AcqirisLive program, such as channel activation and display mode choices are not included.

4.5. Store, Autostore and Conversion of Waveforms

The store menu gives you two mechanisms to store waveforms.

1. The Store Waveform option allows you to store the last acquired waveform for the current channel. To store the last acquired waveform for each of the active channels, you must sequentially select each one to make it the current channel and use the Store Waveform menu command. The title of the Store Waveform dialog indicates the name of the channel that will be stored. The data is stored in ASCII format, as Raw ADC values or Amplitudes (in Volts).

2. The Autostore option allows you to store consecutively acquired waveforms from all of the active channels into files. Configuration of Autostore is achieved by selecting the Autostore item under the Store menu. Autostore brings up the dialog box shown here. Three formats are available for stored waveforms, Binary, Raw ADC values, and Amplitude values (in Volts). The destination folder can be selected or created on any system drive using the Browse button. Waveforms will be stored in a new folder under the destination folder. The new folder will be named **AcqirisRun_{date}_{time}**. Each waveform will be stored in a file with a name {channel identifier}_{i}.{suffix}, where i goes from 1 to N and the suffix indicates the data type. If the data is stored in Binary form, the suffix will be **.data** and an additional ASCII format **.awh** file is written which contains necessary details about each of the other files. Otherwise, the suffix will be **.awd**.



The number of generations of waveforms to be stored with this function is selectable from 1 to N. N is a maximum number dependent on the number of samples taken in each waveform. There is also a user selectable limit on the total amount of data allowed in any single Autostore acquisition series.

When using segmented memory with Autostore, a waveform is considered to be a complete set of acquired segments. When storing Amplitudes, it is possible to write each segment as a separate column of data in the waveform file. This is achieved by clicking the check box option *Segments as columns* in the Autostore settings window. Formatting with segments in columns, in Amplitude format, is limited to 200 segments.

The Binary file format selection provides the fastest storage performance and generates the smallest files on the hard drive. Binary files can be subsequently converted to either Raw ADC values or to Amplitude values using the Data Format Conversion utility provided with AcqirisLive.

Selecting the "Write files at end option" acquires all waveforms into memory first, before converting to the selected format and writing the data to disk. This option allows for faster data capture times. Selecting the "Show waveforms" allows the user to see the waveforms before writing them to disk.

When all parameters are selected, click OK, and then select Normal, Auto or Single acquisition mode. When the waveforms are recorded a progress bar will appear to show the status of the acquisition and of writing the data to disk. The Autostore function can be aborted from the progress bar.

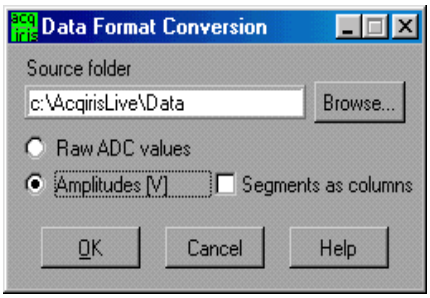
Raw ADC values are the raw 16-bit ADC levels in ASCII format. The channel's gain and offset are needed in order to obtain the signal level in Volts. The required information to convert the Raw ADC values to voltage is included in the header information of each Raw ADC ASCII file or in the **.awh** file accompanying the binary files. In order to convert the Raw ADC values into Volts the following formula should be used.

$$V = vGain * data - vOffset$$

The Amplitudes [V] selection stores the waveforms as voltage samples in ASCII format. This data has already been adjusted for gain and offset and can be directly read out as a voltage. However, it requires roughly twice as much space as Raw ADC value data.

For the sequential acquisition mode, the segment time stamps are also stored when waveforms are saved using the Autostore and Save Waveform functions.

Data stored in binary format with Autostore must be converted before it can be imported into a data processing package or a spreadsheet (e.g. Excel). The Data Format Conversion option is found under the store menu. Select Data Format Conversion in order to bring up the following window. The acquisition must be stopped in order to access this menu.



To convert the binary data, simply select the source folder where the data is located, select the output format and click OK.

All binary data files found in the source directory will be converted to the desired format. If you are writing amplitudes with multiple segments, formatting with segments in columns is limited to 200 segments.

4.6. Calibrate

The Calibrate item in the Options menu leads to a sub-menu where a particular type of calibration can be invoked. In order to use this item the acquisition must be stopped; otherwise the Calibrate option is not selectable.. The possibilities are

- Calibrate instruments - to perform a self-calibration on the digitizers, calibrating the gain, offset, trigger level and the timing. Performing a calibration compensates for any drift in these properties, typically due to component temperature variations.
- Calibrate current combine configuration – to perform a calibration only at the current configuration in each instrument.
- Calibrate External Clock Timing – to do a calibration of the internal TDC in the Continuous External Clock mode.

4.7. External 10 MHz Reference and External Clock

Either one of the External 10 MHz Reference or External Clock options can be selected in the Options Menu. The external input threshold option, available in the options menu, must also be set appropriately. The 10 MHz Reference can be activated at the I/O B output.

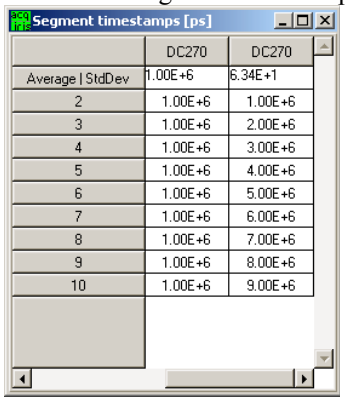
The External Clock function is available in AcqirisLive only when using the control panel in Transient Recorder mode. The input frequency should be keyed into the clock frequency selector (outlined in red) on the control panel in order for the proper timebase to be displayed on the waveform display window. The time window displayed can be manipulated by allocating more or less memory to the acquisition.

The External 10 MHz Reference in AcqirisLive is designed to work either in Oscilloscope mode or in Transient Recorder mode. The timebase and sample rate for waveform capture is fully selectable when using the external reference, just as it is when using the digitizer's own internal reference clock.

4.8. Additional Waveform Information

The Options menu also includes possibilities to obtain additional information about the waveform. In both cases described below the display will be updated after each acquisition.

The "Show Segment Timestamps" option shows a display like the one below:



	DC270	DC270
Average | StdDev	1.00E+6	6.34E+1
2	1.00E+6	1.00E+6
3	1.00E+6	2.00E+6
4	1.00E+6	3.00E+6
5	1.00E+6	4.00E+6
6	1.00E+6	5.00E+6
7	1.00E+6	6.00E+6
8	1.00E+6	7.00E+6
9	1.00E+6	8.00E+6
10	1.00E+6	9.00E+6

It gives you the information needed to better understand the trigger times of the individual segments of an acquisition. By definition the first trigger of an acquisition occurs at $\mathbf{t_1=0.0}$. There are two columns for each digitizer. For the n'th row, the first column contains the difference $\mathbf{t_n - t_{n-1}}$ and the second column contains $\mathbf{t_n}$. The top line contains the average value of the $\mathbf{t_n}$ in the left column and the standard deviation of the $\mathbf{t_n}$ in the right one. The times are in ps.

The "Show Parameters" option activates a display of pulse parameters for each active channel. Inactive channels will have parameter values of 0.0. The parameters will be calculated in a model in which the distribution of measured voltages has two distinct peaks. If this condition is not satisfied the results will be unreliable.

4.9. Display Features

Display features in the Options menu include items for

- turning the waveform display off (by de-selecting "Display Waveforms"),
- modifying the display refresh rate,
- overlaying segments of a sequence,
- connecting displayed data points,
- calculating and displaying waveform parameters,
- displaying the internal temperature of the currently selected module
- displaying a list of segment timestamps.

4.10. Command Line Switches

When starting the AcqirisLive application, the executable's name in the command line can be followed by one or more switches to change the running conditions.

Syntax

The syntax of the command line is the following:

```
path\AcqirisLive.exe [-a][-c][-d][-h][-i][-l][-m][-n][-p][-s][t][-v][-x]
```

Available Switches

List of available switches:

-a **start in Averager mode**

-c **no initial calibration**

-d **use DMA for data transfers (default)**

-h **high priority process (default)**

-i **use acquisition interrupts**

-l **low priority process**

-m **medium priority process**

-n **no DMA for data transfers**

-p **Use acquisition polling**

-s **simulation mode**

-t **temperature update off**

-v **show acquisition state**

-x **disable automatic multi-instruments**

Operation Mode

Acqiris averagers can be operated in *Averager Mode* or in standard *Digitizer Mode*.

AcqirisLive operates in either mode, but since these are mutually exclusive, only instruments that support the chosen mode are accessible in any given mode. E.g. only averagers are accessible in Averager Mode, while both digitizers and averagers are accessible in Digitizer Mode.

The operation mode can be switched within the application. By default, AcqirisLive starts in Digitizer Mode.

Calibration

Before operation, the instruments must undergo an internal calibration. As this calibration can only proceed sequentially for each channel, the initialization time of AcqirisLive can become significant for systems with many channels. Therefore, it can sometimes be desirable to be able to start the application quickly by skipping the calibration (which must then be done "manually" before collecting correct data).

DMA Data Transfers

By default, data transfers on the PCI bus between the digitizer memory and the PC are done in DMA (Direct Memory Access) mode, which allows the fastest transfer speeds (up to about 130 MB/s peak, 100 MB/s sustained acquisition data rate). These very high data rates are not well supported by all hardware configurations (PC motherboard), and system hangs due to endless retries on the PCI bus have

been observed on some machines. Such problems disappear when switching DMA mode off (data transfer rate is then about 2.8 MB/s).

Please note that switching DMA data transfer mode off precludes the use of acquisition interrupts. The –i switch will therefore be ignored when –n is used.

Process Priority

When the program checks for an event from the operating system (e.g. to react to user input), it can put itself to sleep for a specified period of time. This gives other applications more processor time, but limits the performance of AcqirisLive in terms of maximum acquisition rate. The default is not to go to sleep, but this can be overridden to allow better performance for other applications. Note that this sleep policy is only in effect while the acquisition is running. When the acquisition stops, the sleep policy is always reset to the longest sleep period.

Acquisition Interrupts

When performing acquisitions, there are 2 possible ways to wait for the acquisition to complete: *polling* or using a *hardware interrupt*.

- **-p Polling**: AcqirisLive runs as a single thread process. After an acquisition is started, the instruments are regularly polled to check when the acquisition is complete. The user interface is still alive, but the latency for reading the data after the acquisition may vary.
- **-i Hardware interrupt**: In this mode, AcqirisLive is run as a multi-thread process. After starting an acquisition, a new thread is created to wait for the hardware interrupt indicating that the acquisition completed. This thread is put to sleep, and wakes up upon reception of the interrupt from the instrument, or after a 2 seconds timeout.

Please note that switching the DMA data transfer mode off precludes the use of acquisition interrupts. The –i switch will therefore be ignored when –n is used.

Simulation Mode

Simulation mode allows you to run AcqirisLive without having any digitizer installed in the PC.

Temperature Update

The internally measured temperature of the currently selected module is normally displayed. Using this switch turn this feature off.

Acquisition State

This switch turns on the display of the current acquisition state (Stopped, Ready, Started, Reading, Data ready). This is helpful when running with time-consuming settings (e.g. many segments overlaid, many channels, large records, etc.), but will slow down the overall performance.

Multi-instruments

By default, AcqirisLive tries to detect instruments connected through ASBus, and will initialize any connected digitizers as a multi-instrument. This behavior can be inhibited by the -x switch, in which case any ASBus connector will be ignored.

5. Running the GeoMapper Application

5.1. Who needs a Geographical Map of Modules

The GeoMapper application gives the user the possibility of telling the Acqiris driver crucial details of the physical position of modules when this information cannot be deduced directly. It allows the driver to correctly adjust trigger and clock delays between the different modules of an ASBus multi-Instrument and arrange the modules in an intuitive order.

The GeoMapper application has been implemented as a Wizard with the goal of learning the physical position of each module of a multi-bus system. The driver already knows the logical Bus and logical Slot numbers of each Acqiris unit present. However, because of varying conventions for the compactPCI slot arrangement on a bus, this is not sufficient to determine the physical position. Furthermore, with the aid of the map, the software can ensure that the modules of an Auto-defined multi-Instrument will be ordered to correspond to increasing physical slot number.

⚠ ***NOTE:*** The unusual slot numbering convention of the CC121 is documented in the CC121 CompactPCI Crate User Manual. The CC10X crates have a simpler slot numbering convention that the Acqiris driver already takes into account. CompactPCI Crates from other manufacturers represent an unknown element.

⚠ ***NOTE:*** The GeoMapper is of use for some ASBus systems in CC121 crates and, perhaps, crates from other manufacturers. CC121 crate configurations with both an Acqiris acquisition module in one of the last 7 slots and with the PC running under Windows 2000, NT, or XP will not need the GeoMapper. Users who do not need GeoMapper do not need to read this chapter any further.

5.2. When should the GeoMapper Application be used

The application needs to be used whenever the bus or slot configuration of the system changes in a fundamental way. The most obvious trouble symptom is that an expected multi-Instrument was not found. Alternatively the driver can issue error messages that the AcqirisLive application and other programs will see. Among them are

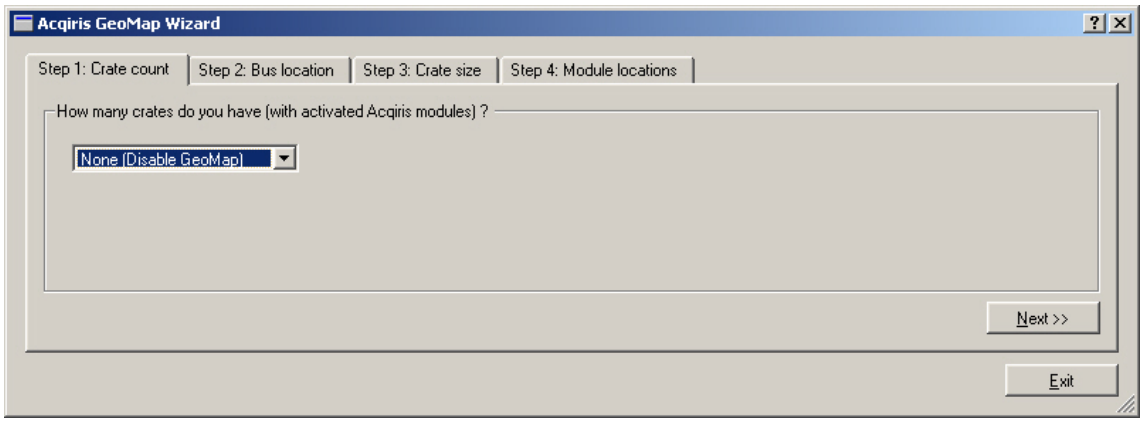
Modules are not contiguous in ASBus combination	ACQIRIS_ERROR_MODULES_NOT_CONTIGUOUS
ASBus Candidate Modules not on same bus	ACQIRIS_ERROR_MODULES_NOT_ON_SAME_BUS
'AcqGeo.map' file is invalid or corrupted	ACQIRIS_ERROR_INVALID_GEOMAP_FILE

In all of these cases the GeoMapper application should be run to ensure that the map file is up to date.

If desired the GeoMapper application will generate a default configuration in which it allows the driver to make all of the choices. This is done by specifying "None (Disable GeoMap)" as the desired configuration in "Step1: Crate count" of the application.

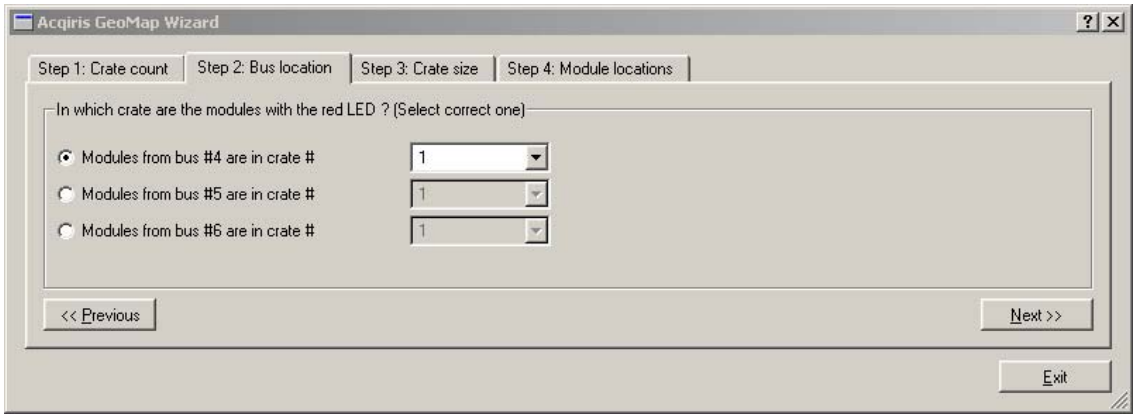
5.3. How to run GeoMapper

After software installation you will find GeoMapper in the AcqirisApp directory of the installation directory. After being started the program will learn about the Acqiris devices present and then show a screen like the one below:


Acqiris GeoMap Wizard
Step 1: Crate count
Step 2: Bus location
Step 3: Crate size
Step 4: Module locations
How many crates do you have (with activated Acqiris modules) ?
None (Disable GeoMap)
Next >>
Exit

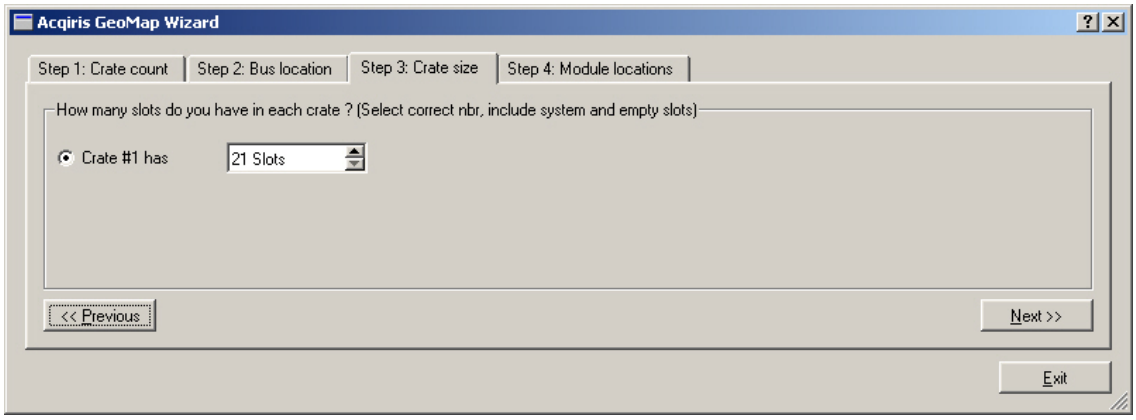
The choice of the number of crates ranges from None up to the number of bus segments that the driver has found containing Acqiris modules. If you choose None and save the resulting AqGeo.map file the system will behave in its natural way without any additional user provided information. If you want to give the driver information on the physical position of modules you should select the appropriate number of crates. If the number of crates does not correspond to your expectations you may have hardware problems (unpowered, broken, or badly cabled crates or modules).

The next step is to associate each bus segment with a physical crate. The menu to do this is shown below:

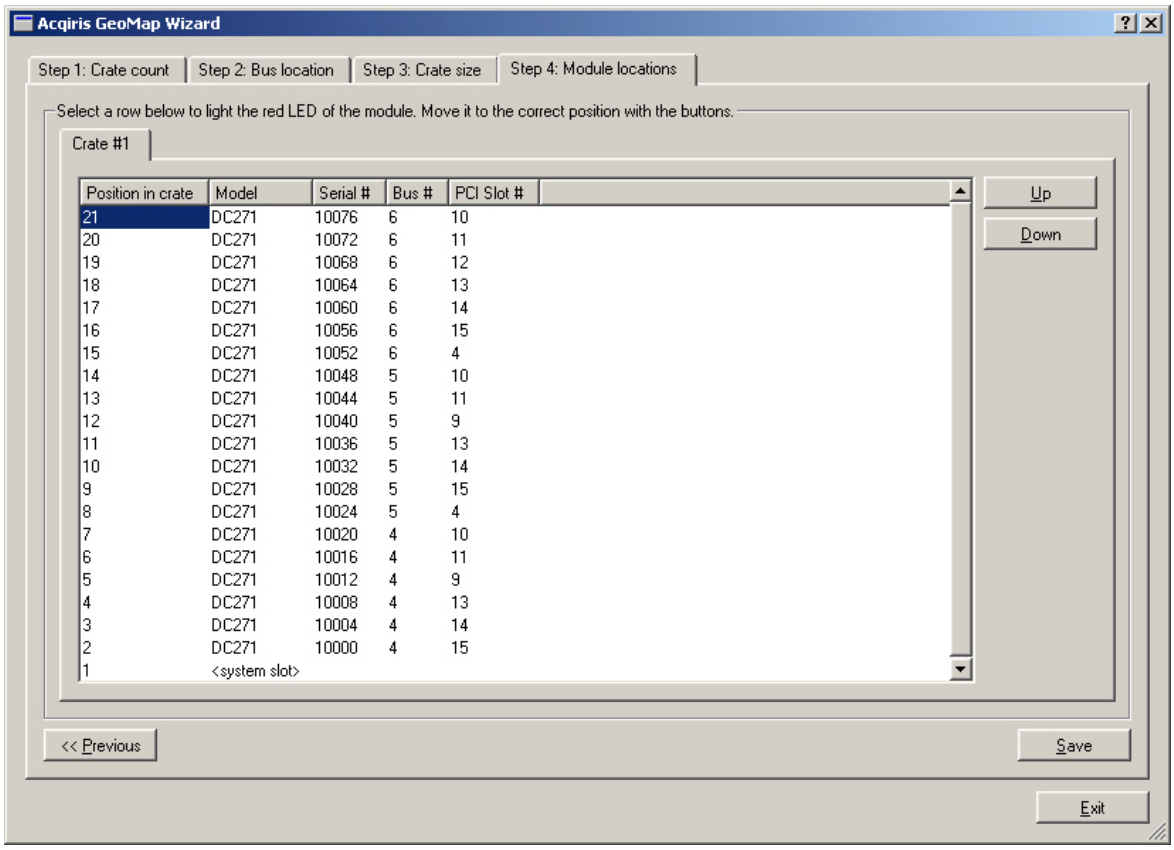

Acqiris GeoMap Wizard
Step 1: Crate count
Step 2: Bus location
Step 3: Crate size
Step 4: Module locations
In which crate are the modules with the red LED ? (Select correct one)
Modules from bus #4 are in crate #
1
Modules from bus #5 are in crate #
1
Modules from bus #6 are in crate #
1
<< Previous
Next >>
Exit

Selecting a row will cause all of the LED's of modules in that Bus to be turned on RED. This should make it easy to identify which crate the modules are in.

The third step is to specify the number of slots in each crate. This is shown below:


Acqiris GeoMap Wizard
Step 1: Crate count
Step 2: Bus location
Step 3: Crate size
Step 4: Module locations
How many slots do you have in each crate ? (Select correct nbr, include system and empty slots)
Crate #1 has
21 Slots
<< Previous
Next >>
Exit

The 4th step consists of arranging the modules of each crate into the correct order. The menu shown below is one in which all of this work has been done for the modules of a fully populated CC121. Selecting a position will cause a module to have its red LED turned on. Then the Up and Down buttons will allow you to move the module in question to the desired "Position in crate".


Acqiris GeoMap Wizard
Step 1: Crate count
Step 2: Bus location
Step 3: Crate size
Step 4: Module locations
Select a row below to light the red LED of the module. Move it to the correct position with the buttons.
Crate #1
Position in crate
Model
Serial #
Bus #
PCI Slot #
21 DC271 10076 6 10
20 DC271 10072 6 11
19 DC271 10068 6 12
18 DC271 10064 6 13
17 DC271 10060 6 14
16 DC271 10056 6 15
15 DC271 10052 6 4
14 DC271 10048 5 10
13 DC271 10044 5 11
12 DC271 10040 5 9
11 DC271 10036 5 13
10 DC271 10032 5 14
9 DC271 10028 5 15
8 DC271 10024 5 4
7 DC271 10020 4 10
6 DC271 10016 4 11
5 DC271 10012 4 9
4 DC271 10008 4 13
3 DC271 10004 4 14
2 DC271 10000 4 15
1 <system slot>
Up
Down
<< Previous
Save
Exit

The final step is to actuate the Save button so that the final configuration will be memorized and made available to the driver.

The GeoMapper application will always work with the standard AqGeo.map file. If you need to have several such files corresponding to different configurations it is up to you to either rename the files or transfer them to other directories in an appropriate manner.

6. Appendix A: ASBus for CompactPCI/PXI Digitizers

Specification and User Instructions

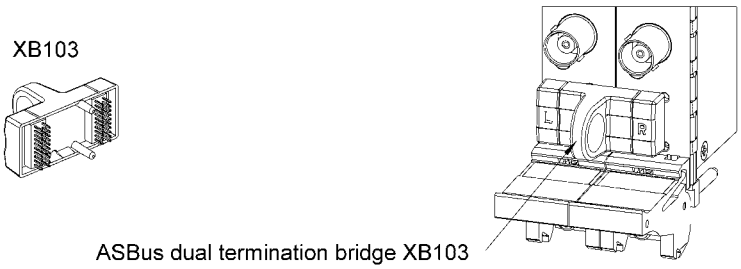
SPECIFICATIONS :

ASBus Bridges allow the connection and synchronisation of up to 7 DC series digitizers (up to 28 channels). Acqiris recommend having the master digitizer in the center of the group in order to obtain the best performance possible.

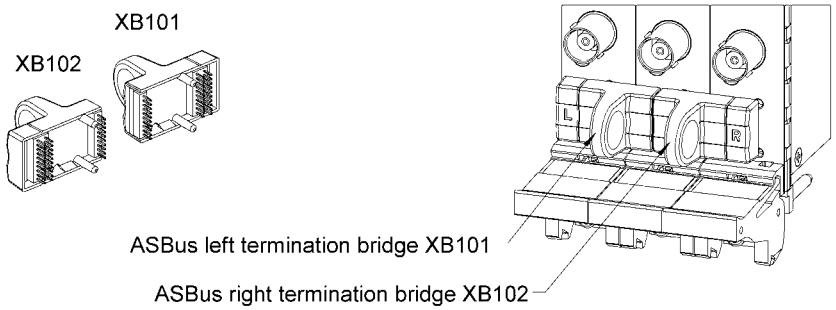
Clock synchronization accuracy : ±100ps.

Important : to ensure the correct operation of the ASBus Bridge it is necessary that each module is securely attached to the crate using the screws provided in the upper and lower handles. Failure to install the modules correctly may result in disconnection of the ASBus Bridge due to pin misalignement.

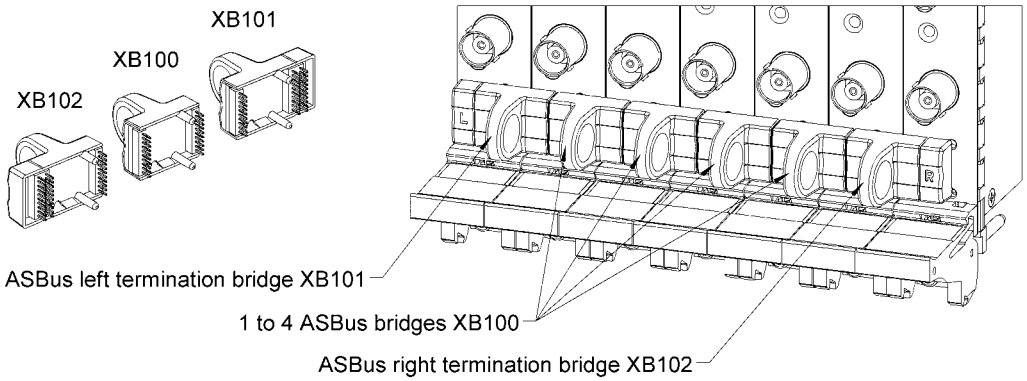
User Instructions for 2 digitizers :



User Instructions for 3 digitizers :



User Instructions for 4 to 7 digitizers :

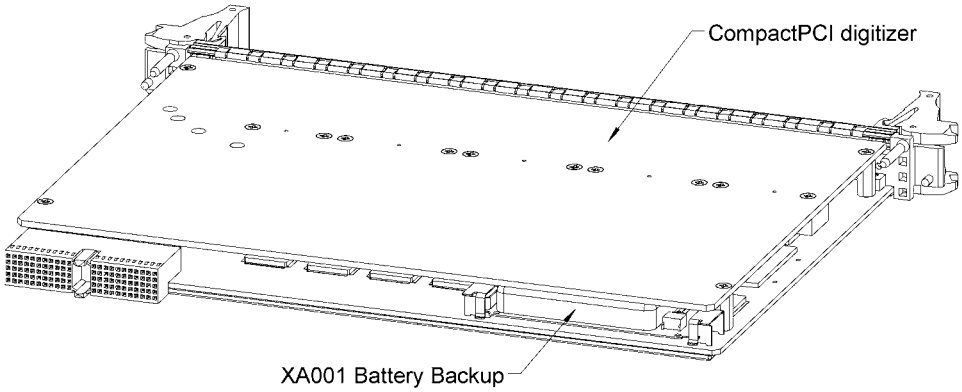


7. Appendix B: XA001 Battery Backup for CompactPCI Digitizers

Specification and Assembly Instructions

SPECIFICATIONS :

Please refer to the user manual for more detailed information on the use of the battery backup.
Time to charge the battery : <2.5 h (digitizer powered)
Backup duration time : without long memory option : >120 h
with long memory option : >12 h
Lifetime : 75% of battery capacity after 500 cycles



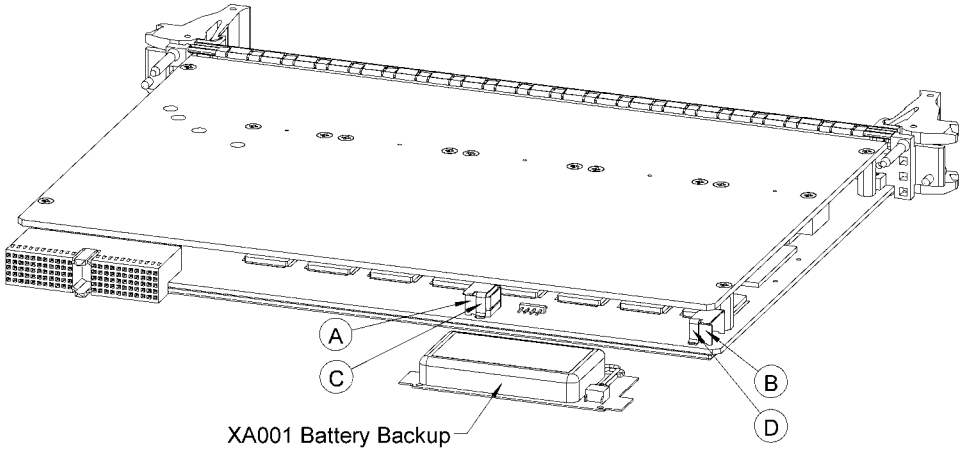
ATTENTION :

The CompactPCI digitizer must always been powered off before either introducing or removing the battery backup and care must be taken in order to avoid electrostatic discharges.

The following steps are necessary to install the battery backup XA001 into a CompactPCI digitizer :

1. Position the battery backup between the guides "A" and "B" insuring that the orientation matches the figure below.
2. Lift the two strips "C" and "D" in order to introduce the circuit board of the battery into the guides "A" and "B".
3. Push the battery in the direction of the card until it hits the stop blocks and ensure that the strips "C" and "D" are correctly and securely attached.

Proceed in the reverse order to remove the battery.



8. Appendix C: XA100 BNC Input Overvoltage Protection

Specifications and User Instructions

The XA100 Acqiris option contain two elements :
- 3dB BNC Attenuator
- 90V BNC Spark Gap

The XA100 overvoltage protection kit allows the digitizers with 50 Ohm only input (without high impedance input) to withstand a high voltage surge of up to 5 kV.

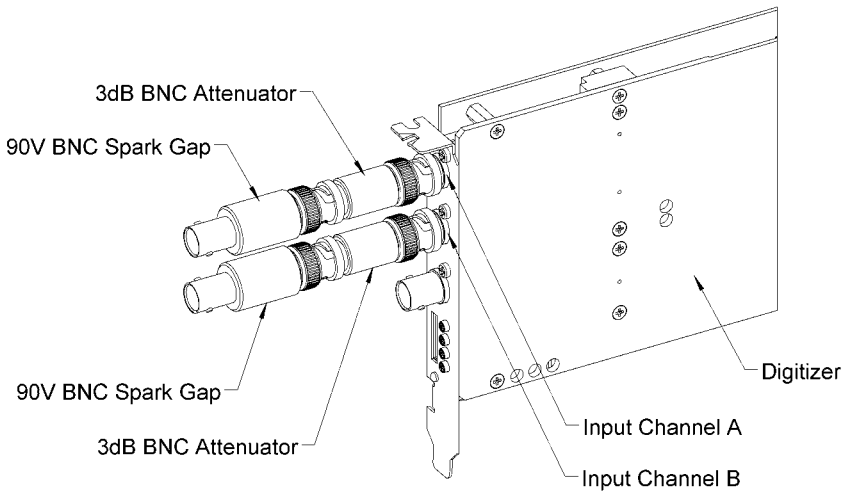
XA100 SPECIFICATIONS :

- Frequency range : DC to 1GHz
- Input impedance : 50 Ohm
- Attenuation : 3 dB
- VSWR, DC to 1GHz : < 1.25
- Impulse discharge current (8/20 us pulse) : 10 kA
- Weight : 60 g
- Length : 85 mm

ATTENTION :

- BOTH the 90V spark gap and the 3dB attenuator MUST be used in order to absorb very high current.

- In order to limit the input current, the attenuator MUST be inserted between the spark gap and the input of the module, as shown in the figure below.



9. Appendix D: XP100 Fan Unit for the DP Digitizer Family

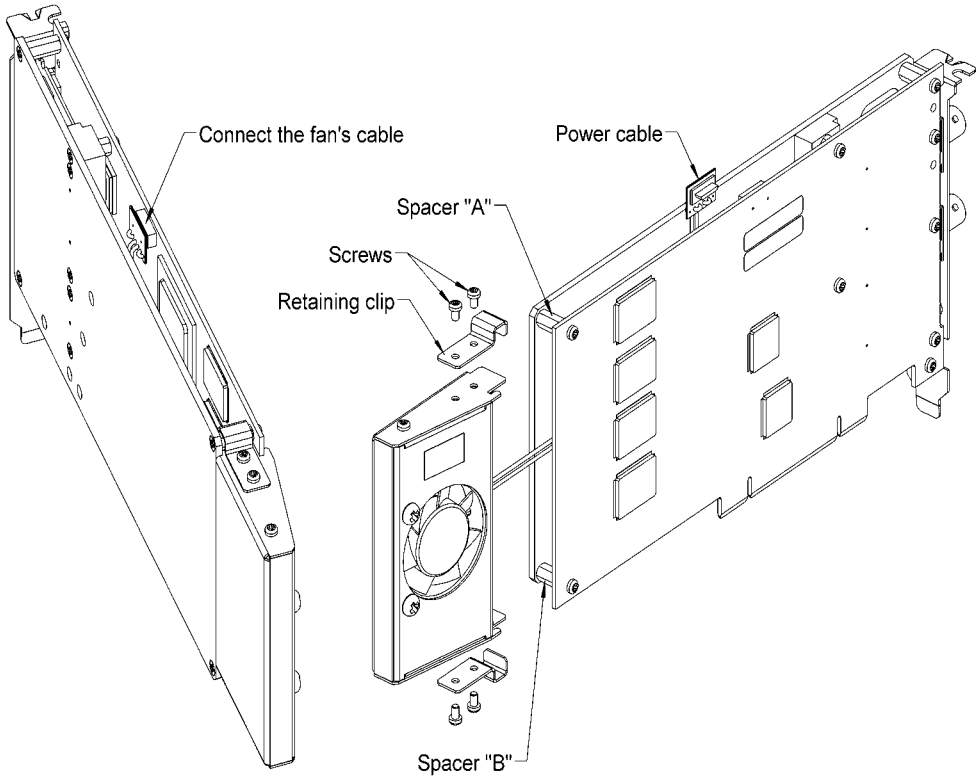
Specifications and User Instructions

SPECIFICATIONS :

Airflow : 8 m3/h, typical speed 6000 rpm, maximal noise 35 dB(A).
Nominal Voltage : 5 VDC.
Power input : 0.8 W.
With electronic protection against reverse polarity, impedance-protected against blocking and overloading.
Operating temperature : 0 °C to 70 °C.
Life expectancy (at 25 °C) : 45000 hours.
Safety approvals : CE, VDE, UL, and CSA.
Materials : Box of stainless steel and fan of fiberglass reinforced plastic, PBT housing, PA impeller.

HOW TO INSTALL/REMOVE THE FAN UNIT ON A DIGITIZER :

1. Remove the digitizer from the PC, prior to installing or removing the fan unit.
2. Unscrew the screws of the retaining clips on each side of the fan unit.
3. Twist the fan's cable a few times in order for the 2 wires to stay together.
4. Introduce the cable between the spacers "A" and "B" at the back of the digitizer.
5. Push the fan unit into the back of the digitizer until the fan's box is in contact with the digitizer cover.
6. Place the two retaining clips on the spacers "A" and "B" and screw again the four screws. Insure that the fan unit is safely attached on the two spacers.
7. Connect the fan's cable as shown in the figure below. The position of the power connector can vary for different model of digitizers.
8. To remove the fan unit, first unplug its power cable and next unscrew and remove the two retaining clips. Pull the fan unit away from the digitizer.



10. Appendix E: XP103 Fan Unit for the DP Family of Modules

Specification and Assembly Instructions

SPECIFICATIONS :

Airflow : 16 m3/h, typical speed 6500 rpm, maximal noise 30 dB(A).
Nominal Voltage : 5 VDC.
Power input : 2.1 W.
With electronic protection against reverse polarity, impedance-protected against blocking and overloading.
Operating temperature : 0 °C to 70 °C.
Life expectancy (at 25 °C) : 50000 hours.
Safety approvals : CE, VDE, UL, and CSA.
Materials : Box of stainless steel, aluminium and fan of fiberglass reinforced plastic, PBT housing, PA impeller.

HOW TO INSTALL/REMOVE THE FAN ON A DIGITIZER :

1. Remove the digitizer from the PC, prior to installing or removing the fan unit.
2. Twist the fan's cable a few times in order for the 2 wires to stay together.
3. Introduce the cable between the spacers "A" and "B" at the back of the digitizer.
4. Push the fan unit into the back of the digitizer so that the two springs lock into place.
5. Insure that the two springs are safely attached behind the two spacers and that the fan's box is in contact with the digitizer cover.
6. Connect the fan's cable. The position of the power connector can vary between different digitizer models.
7. To remove the fan unit, first unplug its power cable and then press on both fan springs and pull it away from the digitizer.

HOW TO INSTALL/REMOVE THE DIGITIZER IN A PCI SLOT OF A PC :

1. Install the fan on the digitizer as described above.
2. Release the three screws "R" from the adjustable retainer and move the retainer against the fans.
3. Introduce the digitizer into the PCI slot and tighten the front panel screw.
4. Push the retainer into the PCI slot guide and tighten the three screws "R". The digitizer is now installed.
5. To remove the digitizer it is necessary to first release the three screws "R" and pull back the adjustable retainer.